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The Outlook

The Fleet Air Arm Again

SIGNOR MUSSOLINI must be very glad that the ships of the Italian Navy were built for speed. Once again their powers of evasion have averted a major catastrophe. But the Swordfish and Skuas from H.M.S. *Ark Royal* are faster than the Italian ships. In the action off Sardinia the second battleship of the *Littorio* class was hit by a torpedo, and as her sister was one of the victims of the Taranto battle, both the most powerful vessels of the Italian fleet are now out of action for some time at least. One 8in. gun cruiser of the *Bolzano* class was "almost certainly" hit by another torpedo dropped by a Swordfish, while a 6in. gun cruiser of the *Condottieri* class appeared to be damaged in the boiler room by a near-miss bomb from a Skua. In these attacks the Fleet Air Arm lost no machines.

Subsequently, when Italian aircraft tried to attack our ships, we lost one fighter while shooting down two float-planes of the enemy. From the Fleet Air Arm point of view, this fight was what Major Mannock, V.C., used to call "good arithmetic."

Tactically, this action by the Fleet Air Arm is the complement to the Taranto battle. In the earlier engagement the attack was made at night against ships moored in harbour; in the recent one it was a case of torpedo attacks by day on moving warships all cleared for action. In both cases all our machines got back safely. In days before the war there used to be discussions as to whether torpedo-bomber squadrons were a species of suicide club, though, of course, it was reckoned that if the R.A.F. lost a dozen or so machines but sank an enemy capital ship, the price would be well worth paying. Even in the inter-war years the Fleet Air Arm was always more optimistic about torpedo-carrying aircraft than were the Coastal squadrons of the R.A.F. Now it appears that such attacks can be carried out either by night or by day, against moored ships or against moving ships, without necessarily losing any machines at all. The results of this air action will increase confidence even as far away as Singapore, whose defence depends to no small degree on torpedo-bomber squadrons.

Once again the *Ark Royal* has proved a very difficult ship to hit. The Admiralty communiqué grows almost dramatic as it describes how the carrier, attacked by three waves of five enemy bombers at a time, disappeared from sight behind the splashes of about thirty bombs falling close beside her. The other ships must have thought that the *Ark Royal* had gone at last. Their delight can be imagined when she emerged from the spray unharmed, and with all her guns firing furiously. Even Signor Gayda does not seem to have thought it worth while to send the *Ark Royal* to Davy Jones once again. The Italians have, however, admitted the loss of two of their aircraft—an unusual fit of veracity. They have also admitted the severe damage suffered by one of their destroyers. The rest of their communiqué on the battle is as inventive as the world has come to expect from them.

The Albanian Campaign

THE Italian resistance seems to be stiffening as their troops fall back from the mountains towards the coast, and it would be wishful thinking to imagine that their humiliating defeat at the hands of the Greeks has ended the power of Italy. Still, this is the moment for hitting the Italians in Albania as hard as possible, and hitting them in such a way as to produce the most immediate results. The destruction of munition factories has slow results, which may not be felt by the front line for months to come. At a moment like this the Allies ought to strike with every available bomber at the fighting troops of the enemy and at their imme-

diate rear. It is known that the Middle East Command has some heavy bombers at its disposal, and they have very properly been planting bombs on Durazzo and the other ports on both sides of the Straits of Otranto so as to hamper the sending of reinforcements from Italy. It would be wasteful to use heavy bombers against the Italian troops or most of the many targets in their immediate rear. That is a job for medium bombers, and if the Middle East cannot spare enough squadrons of that class, it is to be hoped that the Bomber Command at Home will be able to spare some. For the moment targets in Albania need more urgent attention than targets in Northern Europe. If more heavy bombers can have an appreciable effect in converting the Italian defeat into a major disaster, then it would be well worth while to give some of the well-worn objectives in Germany a rest for a space, while blows are driven home on the weaker enemy.

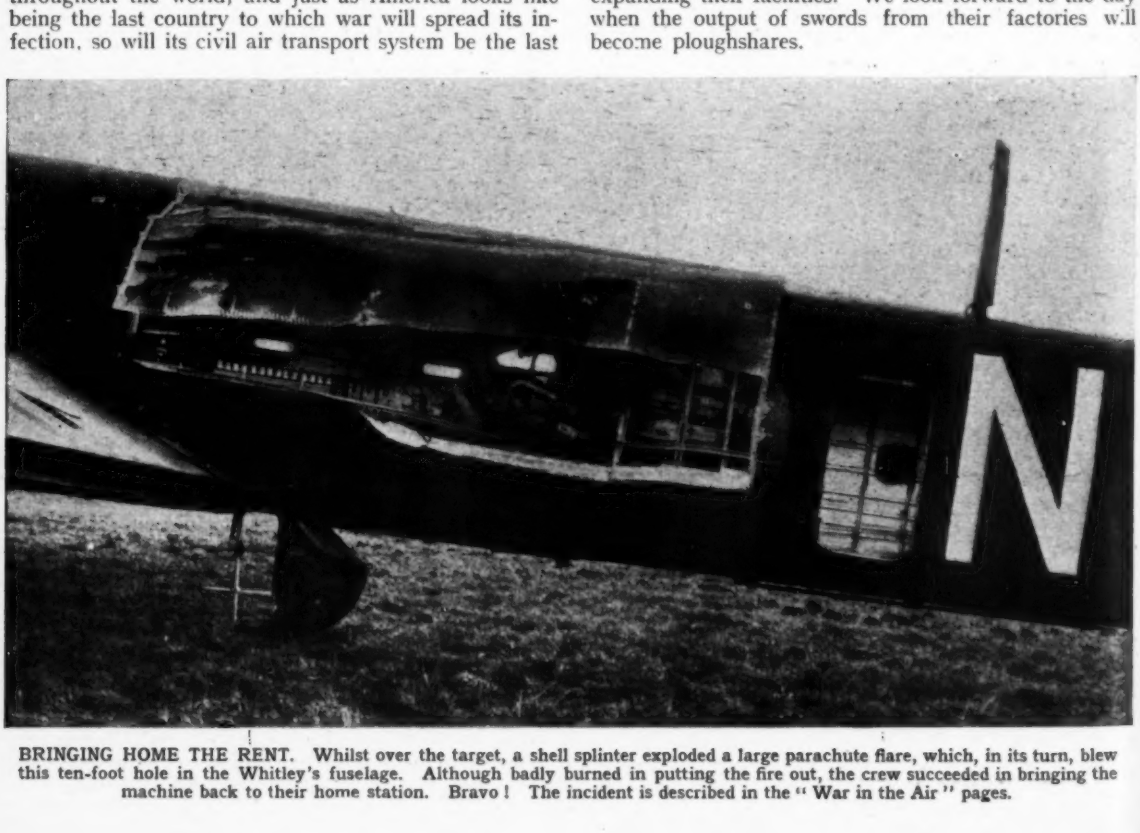
Air forces depend for useful work on properly organised bases, and for that reason their moves are slower than those of either Naval or Army contingents. It would take weeks to get a proper Air Component of the Greco-British force established in the Middle East, and one cannot foretell what may have happened by that time. But what can be done at once ought to be done without thoughts of whether a respite will be given to Germany.

Restriction on U.S. Airlines?

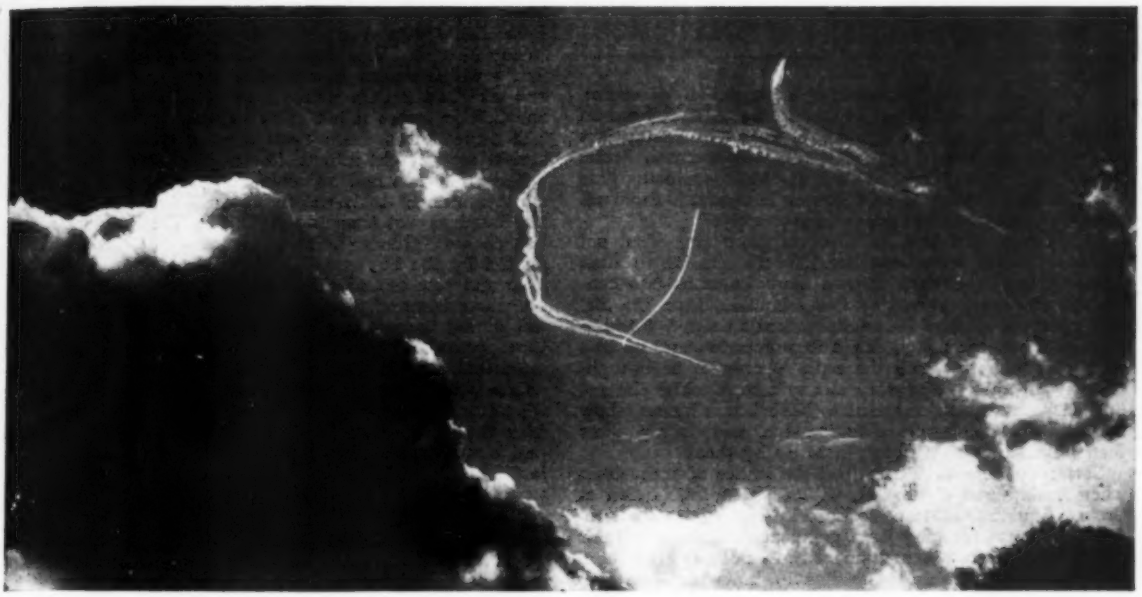
WITH Mr. Stimson, the U.S. Secretary for War, asking the Priorities Board to prevent the expansion of the commercial airlines in U.S.A. so that they will not absorb aircraft which could be available for military purposes, it looks as though the prevailing blight on civil aviation is extending to that country. Such diseases have a way of travelling throughout the world, and just as America looks like being the last country to which war will spread its infection, so will its civil air transport system be the last to be ground beneath the steel-shod heel of Mars. But it is likely to be so ground, though not to the same crushing extent as has happened in this country where, except for the Empire route of British Overseas Airways and a few other small routes, it is in a state of suspended animation.

The march of events has made this inevitable, and if the number of new aircraft required by the airlines in U.S.A. is such that it might interfere appreciably with defence needs of the United States and Britain, the airlines will have to be curtailed. But before doing so, clear thought should certainly be given to that function of the airlines as the swift messenger for facilitating war production which it certainly is. U.S.A. is a huge country and needs a means of speedy communication for its industrial life, otherwise it will be hampered. And to hamper the industrial life of a nation is to put a rope round its neck and aid the enemy in his work of strangulation. So please let an air transport system be retained which will cater adequately for the need for wartime travel, and give the factories leave to produce sufficient machines to keep this fleet always in very efficient condition. And if the travel situation becomes acute through lack of seats it will have to be arranged that those travelling on essential production work shall be given some priority right.

Actually, supply on the airframe side is better than on the engine side, and the Douglas Company's denial that the production of military types has been delayed by that of commercial aircraft is probably quite justified. But this sidesteps the problem, for it cannot be denied that the productive activity which is being devoted to commercial transports could be turned to military aircraft. Engine production has lagged behind airframes in the United States, but steps have been taken to remedy this defect, and Wright, Pratt and Whitney, Ford, Packard and General Motors are hard at work expanding their facilities. We look forward to the day when the output of swords from their factories will become ploughshares.



BRINGING HOME THE RENT. Whilst over the target, a shell splinter exploded a large parachute flare, which, in its turn, blew this ten-foot hole in the Whitley's fuselage. Although badly burned in putting the fire out, the crew succeeded in bringing the machine back to their home station. Bravo! The incident is described in the "War in the Air" pages.



WAR in the AIR

More Fleet Air Arm Successes : A Gallant Air Crew

THE R.A.F. had shot down 20 Italian aircraft on the Greek front up to November 27. So Capt. Balfour told the House of Commons last week. He added that since November 19, when eight Italian machines were shot down by R.A.F. fighters without loss to themselves, few of the enemy machines have been met on the Greek front. This shows that it is not the mere number of machines destroyed which counts so much as the moral ascendancy which the R.A.F. fighters have established. The actual losses cannot seriously deplete the resources of the *Regia Aeronautica*, but the Italians have not really got their heart in that war. They would have had no objections to a walk-over, which was what they had expected, but bitter fighting was not at all to their mind. The R.A.F. men, wherever they are, always put all they know into their fighting and bombing efforts, and the Greeks themselves, fighting to save their country from a most unscrupulous invasion, are all out. The Greek pilots also have had their successes, and six Italian aeroplanes have been captured on their aerodromes at Koritza by the advancing Greek Army. They are said to be only slightly damaged and quite able to be repaired. Even small contributions of that kind are thankfully received by the Greek air arm, which is small in resources, though great in spirit.

At the same time the bombers of the Middle East Command continue to raid Durazzo, the principal Italian base port in Albania, and other ports, while the Bomber Command in Great Britain has been sending a succession of raids against the Royal Arsenal at Turin and other munitions works in Northern Italy. The Royal Navy, too, is interfering with the communications between Italy and Albania It is not to be expected that all communications between these two places can be cut, and no doubt the Italians will continue to get quite a fair amount of material into Albania, but the amount will be reduced by the British action, and it is not likely that the Italian sailors and soldiers will feel in the mood to run serious risks in the effort to get the stuff landed. The Italian tails, judging from the reports which come through, are now pointing in an earthward direction.

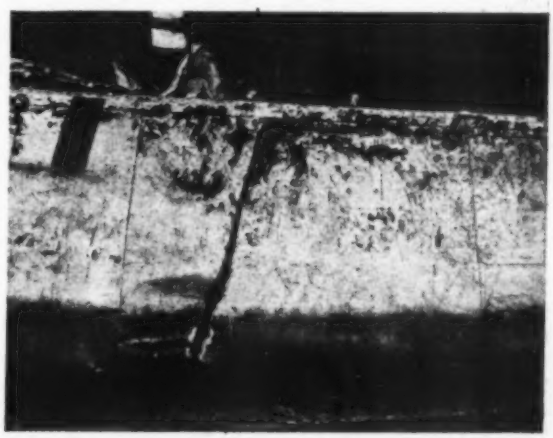
The following communiqué from Cairo describes some of the bombing operations:—

"Despite intense anti-aircraft fire and enemy fighter opposition a highly successful raid was made on Valona harbour yesterday (November 26) by bomber aircraft of the R.A.F. Direct hits were obtained on a big ship, which was seen in a sinking condition before our aircraft set out on their return journey. Damage was also done to the quays and docks area, while buildings near aerodrome hangars were destroyed. One of several enemy monoplane fighters which attempted to intercept our bombers was shot down. It was last seen diving vertically with black smoke pouring from its fuselage.

"A column of Italian troops retreating in the Tepelene area was attacked by our aircraft, causing heavy casualties.

"At Kelcyre a stick of bombs fell across an aerodrome, one bomb exploding close to an aircraft on the ground.

"On Monday (November 25) one of our aircraft, return-



THE UNKINDEST CUT : One wing of a Heinkel He 111 which ran into the cable of one of our balloons on Beckton Marshes. It was found some two miles from the main wreckage. The cable cut is very apparent.

WAR IN THE AIR (CONTINUED)

ing from a raid, while avoiding a formation of enemy fighters, C.R.40s, came out of cloud only to meet head-on another flight of Italian fighters, G.50s. The enemy was surprised and, attempting to evade our aircraft, broke formation quickly. Two of their machines collided. One was last seen diving to the ground in flames. From all these operations our aircraft returned safely."

Of course, the R.A.F. medium bombers, also not numerous as yet, have been attacking the retreating Italian ground troops and have thrown many columns into confusion. Troops never enjoy being bombed from the air, and, once the spirit of retreat has seized an army, the individual soldiers are less prepared than ever to stand up to a form of attack to which the reply is only to be brought off by well-trained and very steady troops. The Greeks, flushed with success, are said to have learnt by now how to deal with the Italian dive-bombers, and do not allow their advance to be seriously held up by them.

Correspondents have described the scenes of enthusiasm when a ship-load of airmen, with their stores, landed at Crete. Squadrons thrown forward in a hurry to new aerodromes cannot for long keep going at full blast. Their maintenance men and equipment must be sent after them as quickly as possible. The R.A.F. units must be well dug in at Crete by now. It makes a splendid base for hitting out either to the East or to the West.

On the southern shores of the Mediterranean the Italians have been doing no better. Recently we recorded briefly that four Gladiators flown by pilots of the R.A.A.F. got the best of 17 Italian fighters. Details of the combat are now to hand. The Australians came out of their first fight in the Middle East with flying colours. They lost one officer and one aircraft, but it is definitely established that three C.R.42s were shot down and probably two or three others. The pilots of the four aircraft were a Squadron Leader, a Flight Lieutenant and two Flying Officers. They were returning from patrol over enemy territory when they encountered seventeen C.R.42s, which were giving fighter protection to Italian troops on the ground. A general dog fight ensued. The Flight Lieutenant found himself with nine enemy fighters around him and he attacked one of them. At fifty yards range, he opened fire and the C.R.42 dived and crashed. He was then pursued by three others but he got a good burst into one of them and when last he saw this aircraft it was diving into the clouds with black smoke pouring from it. Meanwhile the other three Australian pilots had individually attacked the other enemy aircraft. One Flying Officer engaged as many as four separate enemy machines in turn. He said that he saw his tracer bullets hitting the cockpit and the engine of one C.R.42 before it fell away apparently out of control. The same officer made three stern attacks. "I could almost see straight into their cockpits," he said, "and I believe that one had no room to pull out of a dive and another seemed to be in an uncontrollable spin at only two hundred feet from the ground." This pilot then saw two enemy fighters on the tail of the Australian aircraft piloted by the Squadron Leader. He went to his assistance and saw one of the Italian machines fall away and disappear beneath him. He said, "I did not see it hit the ground because another C.R.42 attacked me. By this time my ammunition had run out and I was thankful to see the enemy make off." The other Flying Officer having beaten off the enemy aircraft which attacked him saw the Gladiator piloted by the Squadron Leader diving away from the fight. He followed him down hoping to see him pull out near the ground but he saw the aircraft crash instead.

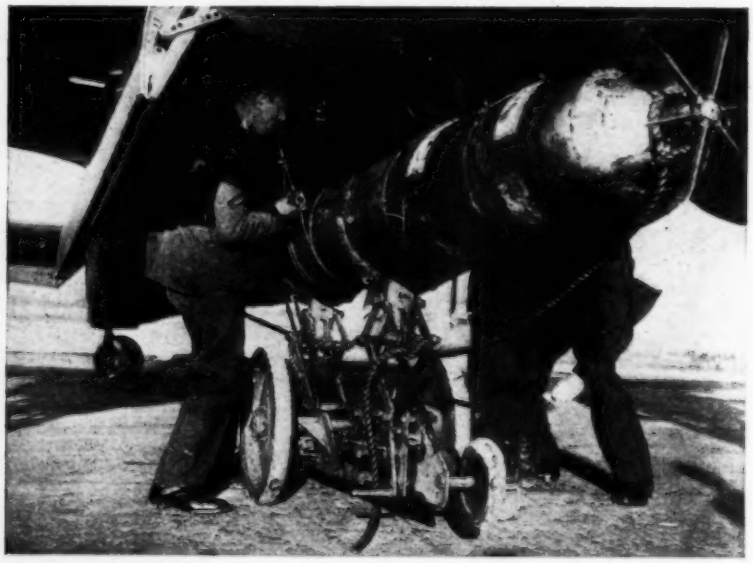
British Bombing Attacks

THE second wave of U-boats is now at work attacking British shipping, and the sinkings have become a matter which cannot be dismissed as of no account. The aircraft of the Coastal Command keep a sharp look-out for U-boats and their victims, and sometimes save valuable lives. The following story tells of one such rescue:—

"I undoubtedly owe my life to the vigilance of the officers and crew of the aeroplane," wrote the captain of a torpedoed ship to the captain of a Coastal Command Anson which had helped in his rescue. The ship was sunk in the Atlantic in less than a minute. Captain Whitehead, whose home is in Leeds, was the sole survivor. He was on the bridge at the time, and was thrown into the water. During eight hours of darkness he clung to the wreckage, and then climbed on to the keel of an overturned lifeboat. After holding on for another four hours he was seen by the captain of the Anson, a Pilot Officer, who circled round and then flew off to fetch a rescue ship. Twenty-four miles away he found a warship which he guided to the spot. He remained over the lifeboat until he saw the skipper taken safely aboard. The other day the pilot received a letter from Captain Whitehead, then on leave at his home in Leeds, thanking him for saving his life. The pilot, in reply, sent a copy of a photograph taken from the aircraft, showing the skipper standing on the upturned boat, and waving. Four cigarette cases have now arrived for the crew of the Anson, accompanied by a letter from Captain Whitehead which states: "A wonderful feeling of security goes through all the chaps in a ship when we see one of you in the vicinity. I am awfully glad to have the photographs, which will always be a very vivid reminder of the bond between the R.A.F. Coastal Command and the Merchant Navy."

German bombers help the U-boats in their attacks on the ships, and a base has been established for them at Merignac, near Bordeaux. Lately the Bomber Command has been paying a lot of attention to Merignac, and there has been a series of heavy raids directed against the aerodrome. One of the raids, that on Sunday, November 24, was thus described.

The raid was at its most severe round about 4 o'clock in the morning. Once the attack had begun our pilots could have done without the moon, so effectively were they guided to the aerodrome by fires already burning there. One pilot saw the fires when



MOULDY STORAGE: A torpedo being loaded on the internal crutches of a Bristol Beaufort. The "whiskers" on the nose ensure detonation of the explosive charge even if the ship is struck only a glancing blow.

TARANTO BOMB D.A: A 250 lb steel-armour-piercing bomb on one of the special trolleys used by the Fleet Air Arm for bombing up.

he was 100 miles from his goal, and, as he put it, "There was no more navigation to do." When the flares were lighted as well, every detail of the aerodrome could be seen, and the rear-gunner of one aircraft could even see the bombs falling towards the roofs of five great hangars. When they exploded he saw holes gaping in every roof. On the aerodrome itself many aircraft were burning, and when direct hits were made on the barracks the pilot was able to make the laconic report, "Destroyed." Looking back, another observer compared the hangars to "great skeletons with their ribs silhouetted against the fires glowing within." High-explosive and incendiary bombs were dropped both from high and low levels, shallow dive attacks were made at intervals, and some aircraft came down to use their machine guns.

The Blohm and Voss shipbuilding yards at Hamburg, which have been so often raided in recent weeks, were once again visited by R.A.F. heavy bombers on the same night, November 24. The first attack was made between 7 and 8 p.m., and during this one hour many tons of high-explosive bombs, together with nearly 2,000 incendiaries, were dropped on the vast acreage of the most important privately owned shipyard in Germany. The reason for so many raids on this one objective is that no one raid could destroy more than a part of the shipyards, and it is certain that the Germans will have been making every effort to repair the widespread damage that we know has already been done. This yard has four slips, 800 feet long by 100 feet wide, four smaller slips, 400 feet long by 80 feet wide, and eight floating docks. There is much work for our bombers to do. During recent years an enormous graving dock has been building. If the R.A.F. had allowed, it would have been ready this year. So extensive are the yards that the great Blohm and Voss aeroplane factories appear, when seen from the air, to be merely a small appendage at one side of the whole concern. There was thick cloud over Hamburg, but in spite of every obstacle our pilots were able to see their bombs exploding on the target and afterwards they observed a good number of fires and explosions. Our bombers made a concentrated attack and several dropped their bombs at the same moment.

WAR IN THE AIR (CONTINUED)

The second attack on the shipyards was made at about 4 a.m. The weather was even more unfavourable, and though bursts were seen on the yards, clouds prevented any final observation of the results.

Berlin has been raided a number of times since the last issue of *Flight*, and there have been raids, too, on Kiel, Cologne, and all the regular targets in Germany whose names must now be familiar to all. German fighters are met with rather more frequently than they used to be, but often the men in the bomber catch a glimpse of an Me 109 or 110 flashing past, and conclude that the Germans have not seen them. Sometimes an attack is made, and it may usually be expected when the *flak* dies away. One night British pilots reported "an uncanny silence" over Berlin.

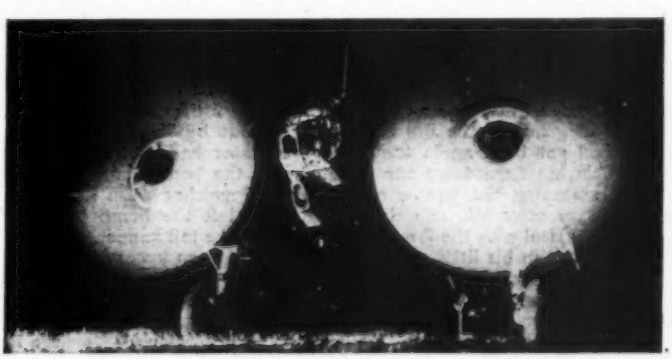
German fighters were about, and during one of the lulls in the ground fire one of our bombers, while it was held in the beams of a searchlight, was attacked by two of them —they were probably Messerschmitt 110s. The encounter was very brief. The fighters came in from above and fired green and red tracer bullets. The pilot of the bomber turned in towards the attackers and so managed to avoid their fire. The fighters broke away and almost immediately the anti-aircraft fire began again. Aircraft arriving towards the end of the raid said that the barrage was then very heavy.

Raids on Great Britain

SINCE the heavy raid on Coventry, night bombing attacks have been made on Birmingham, Southampton, and Bristol, and considerable damage was done in all three places. For several nights in succession the raids on London were anything but heavy; only a few bombers flew over the Capital, and the number of bombs dropped was small. Bright starlight nights over London do not always mean that the weather is so good over the French aerodromes. They are subject to fog, and many of those which the R.A.F. were using last year are apt to get waterlogged. In such circumstances only the more expert German pilots will venture to take off, as they all know the hazards of landing a machine in the dark in such circumstances. Moreover, as we know from our own experiences, all the machines which return to their aerodromes are not unscathed. A.A. shells damage many which do not immediately come down. In addition, there is the risk that while the Germans are absent over Britain, some R.A.F. bombs may have made awkward craters in the aerodromes from which they started, and the holes do not add to the confidence of a pilot who is coaxing a battered bomber home.

A Tough Adventure

ONE of our heavy bombers, while over its target, was hit by a splinter which penetrated the fuselage. Sheer misfortune carried the splinter to an outsize in flares and blew it up. The aircraft was soon like a derelict work-



FOR EVEN GROSSER DEUTSCHLAND: A Junkers Ju. 88 running up its engines before taking off for a night raid on England.

WAR IN THE AIR (CONTINUED)

shop inside, but the pilot brought it home.

"We were off just before midnight," said the pilot, "and set course for the oil refinery at Wesseling, Cologne, where we found a large patch of clear sky stretching some thirty miles along the Rhine. We went straight to the target, but unluckily the clouds were there before us. We could not see the ground at all. We circled for fifty minutes hoping that it would clear, then we decided to attack the railway goods yard at Cologne before that was obscured, too. We could see the yard clearly enough. The anti-aircraft gunfire, which had been very severe and accurate for the last hour, slowed down, and it seemed as though we could not miss our new target. The bomb doors were open, the wireless operator was standing by to drop the great flare and the bomb-aimer had started giving the usual alterations of course. Then anti-aircraft fire opened up intensely again, and one shell burst very close. It was what is technically known as a near miss, but it was near enough for fragments to hit us. There was a blinding explosion from the front, the perspex of the front turret was blown away, and there was another terrific explosion in the fuselage. The shell had touched off the flare. The observer and the wireless operator were both injured, and a ten-foot hole told the tale of the rear explosion, but not quite all of it. Nor did we see the hole at that moment. We were busy. The explosions had hurled the control column out of my hands, and the cabin filled with dense black smoke. I remember asking the bomb-aimer if he had dropped his bombs, but the only answer I got was, 'I've been hit.' Very soon the smoke cleared a little, and to my amazement I saw that, not only were the engines still there, but that they were both running. Then the bomb-aimer came up through the well, his face streaming with what looked like blood. He was holding his head, and could not stand upright. I could not possibly help him since it was all I could do to regain control of the aircraft. Suddenly he shouted 'Fire!' and staggered along towards the tail.

"A little later I looked round and saw the wireless operator coming through the door with flames licking his flying suit. He was on fire himself. The bomb-aimer dashed up to him and beat the flames out with his hands. Then he disappeared down the fuselage again. He seemed to have recovered completely, and it turned out that what I had taken to be blood was only oil. Then the cabin cleared of smoke, and things seemed to be fairly all right except that the aircraft was flying in an erratic sort of way. Back in the body of the machine the crew were working frantically to get rid of the incendiaries and anything that might explode. We carried on in this state and dropped our bombs. We hadn't made the journey for fun, and the job had to be done as best we could do it. Then the second pilot came forward and reported that the fire seemed to be under control. On seeing fire break out he had gone for the fire extinguisher. But by the time he had got back again the wireless operator had pushed the blazing flare down the 'chute' and the bomb-aimer was stamping the flames out. The extinguisher wasn't necessary after all. So the second pilot left the bomb-aimer to deal with the fire and went back to the tail gunner, cooped up in his little glass turret, who had been knocked out by the explosion. He had come to, thinking that the turret had been blown completely off and that it was falling through the sky. It turned out that it was he who had said, 'I've been hit' while he was unconscious.

"During this time the wireless operator and I were alone in the cabin. He had collapsed on the floor and said, 'I'm going blind, sir.' His face was burned completely black, and it looked as though blood was streaming from his eyes. When the crew returned I sent the second pilot back for the first-aid outfit and told the others to look after the wireless operator, who at first refused to be helped. He got to his feet and said, 'I must get to the wireless.' As soon as his burns had been attended to, he clambered to his wireless and started to send out messages saying that we were on our way back to base. But first he had to explain the settings of the dials to the rear gunner, and when everything was ready he had his hand guided to the key. For forty minutes he stood like that, tapping out his message, but the aerial had been shot away and nothing got through.

"Then we took stock. We found the front turret holed, both doors gone, and the ten-foot hole in the fuselage itself. The fuselage had been twisted, and that accounted for the wallowing motion of the aircraft, but we were able to maintain height, and by running the engines carefully could make a decent speed. It took us five hours to get home—there was an 80-mile wind against us. All those hours the wireless operator made no moan or complaint, although he was suffering from the intense cold as well as from his burns. He asked for nothing in the way of treatment, and did not even admit that he was suffering. When we told him we would land at the nearest aerodrome he begged that we should go the extra 100 miles, so that we could all get back to our friends and let them see that we were safe."

AIR LOSSES DURING THE WEEK ENDING NOVEMBER 30

	GERMAN Aircraft	BRITISH Fighter Aircraft	BRITISH Pilots
Nov. 24	6	—	—
" 25	1	—	—
" 26	4	—	—
" 27	12	2	—
" 28	5	7	6
" 29	5	2	—
" 30	5	2	—
	38	13	6

British Bombers lost over enemy territory :—Nov. 24, 1 ; Nov. 25, 1 ; Nov. 26, 5 ; Nov. 27, 1 ; Nov. 28, 2. Total 10.

Correction. On Nov. 16 no British fighters were lost, but 3 bombers were lost.

The "Ark Royal" Scores

THE great air victory of Taranto went to the credit of the Fleet in the Eastern Mediterranean and the carriers Illustrious and Eagle. On November 27 the other part of the Fleet in the Western Mediterranean with the carrier *Ark Royal* got in touch with the surviving strength of the Italian Navy. After Taranto the Italian sailors must have felt somewhat downhearted, so the remaining battleship of the *Littoria* class, accompanied by another battleship of the *Cavour* class and a large number of cruisers and destroyers, was sent out for a cruise. It was probably the wisest thing to do with them, and as they cruised off the South of Sardinia it was probably thought that they would be quite safe and could feel that they were ruling the sea. But at 10 a.m. the T.S.R. from the *Ark Royal* spotted the Italian ships. At the same time an Italian aircraft discovered Admiral Somerville's force, but a fighter from the carrier shot it down. The British ships were outnumbered, and the battle cruiser *Renown* should have been no match for the two enemy battleships. But the Admiral at once went for the enemy, who turned and retired at full speed for their base. One of their cruisers was set on fire by a shell fired at extreme range, and two destroyers were badly damaged. Then the Swordfish of the carrier, armed with torpedoes, set out after the flying Italians. They daringly dashed through the screen of destroyers, which fired at them for all they were worth, and planted torpedoes on the modern *Littorio* class ship and on a cruiser. Skuas dive-bombed the cruisers, and one ship seemed to be hit in the boiler-room. When Italian bombers approached our Fleet, the Skuas shot down one of them, and none of their bombs did any damage. We lost one Skua, and H.M.S. *Berwick* was hit by a shell, which killed seven, but did not incapacitate the ship.

Other Fleet Air Arm units attacked the port of Leros in the Dodecanese and Tripoli in Libya, while another warship, with the co-operation of aircraft, bombarded targets near Cape Gardafui in Italian Somaliland. One of our aircraft was lost in the Eastern Mediterranean operations.

AIRSCREW SPINNERS—II

The Development of Spoked, Cooling and Bullet-proof Types

By F G. MARSHALL and P. BURTON

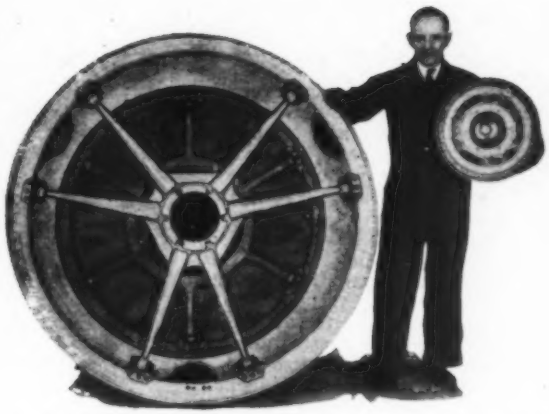
(*Continued from page f, November 21*)

THE first article of this series dealt with those forms of spinners which are well known and are at present in quantity production. It is now proposed to discuss some types which are not yet universal, and which embody many interesting features.

Due to the fact that the rear diaphragm of a spinner is a fixture at the rear of the airscrew, it is necessary to dismantle the airscrew from the airscrew shaft in order to make any adjustments to the many important engine auxiliaries mounted on the front of the engine. Therefore, the diaphragm can be replaced very effectively by a spoked arrangement both at the front and the rear. The ring carrying the locking device at the rear would have a diameter slightly smaller than the cowling ring, and would be supported by spokes, probably six in number, three being placed in line with the airscrew blades when a three-bladed propeller is fitted. This would allow access to the front of the engine without the necessity of dismantling the airscrew. In operation the shell and the front set of spokes would be released instantly by the quickly detachable fixing from the outer ring and rear spokes, exposing the front of the engine without any further dismantling of parts.

By resorting to this method of supporting a spinner a large reduction can be made in weight. The section of the spokes would, of course, be determined by the loads they would have to carry; normally for a 40in. diameter spinner the spoke width at the top is 1½in. and at the bottom 3½in., the spokes being of "H" section. The material used for either front or rear spokes can be one of the many ductile light alloy castings, or perhaps preferably a forging or die casting. With this scheme it is possible to keep the spinner weight-diameter ratio proportionate within reason, and in doing so stresses set up in the spinner, chiefly from centrifugal forces, are maintained at a controllable level. Hence the construction of a spinner could be eventually standardised irrespective of size. The attachment of the spokes to the shell can be either rigid or resiliently mounted by means of bosses integral with the spokes carrying cush mountings either transversely or longitudinally.

A cooling spinner with blades extending to the full diameter.



A V.D.M. spoked spinner of the type referred to by the authors.

The accessibility to the front of the engine would, of course, be the chief object of this design. Provision has been made, in small-diameter spinners, by means of holes in the rear diaphragm to enable certain fixtures on the front of the engine to be more accessible; but in practice this is not very successful (unless a clear space of reasonable dimensions is allowed), as apart from the difficulties arising from the weakening of the rear diaphragm, it would necessitate the removal of the airscrew from the airscrew shaft in order to carry out any major adjustment. This arrangement also lends itself very well to facilitating the cooling of the engine through the spinner.

Cooling Spinners

Various attempts have been made in this country and abroad to cool a radial engine on the ground and in flight by means of a fan or series of fans mounted at the rear of the airscrew and in front of the engine. Very few of these attempts have been made in collaboration with spinner manufacturers, and whether or not development is reaching perfection, one thing is obvious, and that is that the real future of the radial engine is intimately associated with the ability to perfect the streamlining of the installation. So whatever method is adopted for cooling, whether by reverse flow or by a cooling spinner, the method must not detract from the efficiency of the streamlining. For example, if reverse-flow cooling is used, the inlet apertures must not be of such a size as to replace the conditions of an un-streamlined engine, and with this point in view the cooling spinner appears to be a better proposition.

The ideal scheme is a fan driven at a rate of probably four times engine speed, with perhaps a stationary fan installed at the rear to straighten out the flow, but at present the complicated gearing required to attain this renders the proposition impracticable. The disadvantages of a fan incorporated in a spinner have been due to its low peripheral speed, and ingenious designs to produce conditions of an ordinary fan running at least four times faster have been evolved.

One of the cooling spinners in question totally encloses and streamlines the radial engine. The spinner is supported by means of spokes at the front of the airscrew. A fan having multi-blades of special design reaches to the maximum diameter of the spinner, and replaces the rear diaphragm. Thus a maximum peripheral speed for the fan for a particular spinner size is obtained, the fan being

AIRSCREW SPINNERS (CONTINUED)

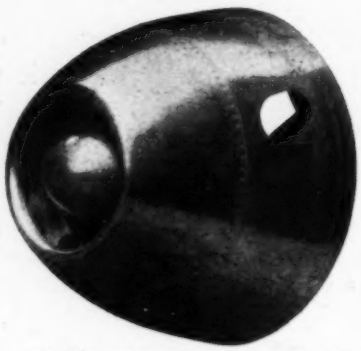
fed with air from an aperture in the apex of the nose of the spinner. Inside the aperture a nose cap or fairing is fitted to the front of the airscrew in order to ensure a free passage of air to the fan and so avoid the turbulence that would be set up due to the irregularities of the airscrew hub.

For ground cooling it has been determined that it may be advisable, in order to increase the quantity of air flow to the engine, to pass the air flow set up by the spinner fan through the exhaust manifold system and so increase the injected air by induction. In practice, best results have been obtained when an outlet is situated in a region of low pressure, such as the upper surface of the wing. Naturally, this method will give overcooling in flight, and therefore controllable apertures are manipulated from the cockpit so that the cooling air from the fan is by-passed directly to the atmosphere, thus obtaining no assistance from the exhaust systems. The limiting features determining the minimum diameter of the aperture possible in the nose of the spinner is governed by the quantity of air required for ground cooling, with or without the assistance of induction of the exhaust system.

As an example of the great possibilities of this scheme, it is common knowledge that the Vickers "Venom" with a nine-cylinder Aquila engine of approximately 600 h.p. obtained a top speed of 312 m.p.h. The top speed of this particular machine could be raised probably 30 to 40 m.p.h. with a streamlined frontal area, providing suitable cooling facilities could be arranged.

It is not possible to cover the whole field of complications attached to this scheme, but it can be safely said that the possibilities of the cooling spinner are very great.

If a frontal view of a modern fighter in flight is observed, the predominant feature is a large spinner from which a thin wing on either side appears to protrude. Consider then the psychological effect on a pilot sitting behind a spinner which he knows to be bullet-proof, quite apart from limiting the possibility of engine damage.



A bullet-proof spinner acts partly by virtue of its shape and speed, and partly by the material of which it is made.

The spinner has two natural tendencies to impede the piercing of a projectile through its shell, one being its aerodynamic shape. For example, should a projectile be travelling in a direction parallel to the thrust line, it would strike the surface at an angle which would offer more resistance to penetration than a flat surface. The other point is that the velocity of the spinner, due to the high speed of revolution, alters the angle of deflection considerably. This minimises the rate of change of momentum and thereby decreases the force of the blow on the spinner. When combined, these two features have even greater significance, with the resulting tendency for the projectile to ricochet off the spinner surface.

The principle is to provide an additional surface protection on a spinner shell, the shell acting as a base for its incorporation. This can be done in numerous ways, but it is, of course, a matter of determining the lightest method of doing this. Methods already investigated are steel-shelled spinners, steel-latticed, rubber-enclosed spinners, and spinners having various hardened surfaces. But here again it is not possible to give details of the method considered most effective.

It must be realised that it is not essential to make a spinner assembly strictly bullet-proof in the true sense of the word, providing a surface can be so arranged that, although it is pierced by a projectile, its velocity is so diminished that it renders the projectile indestructive before it can reach any of the important auxiliaries mounted in front of the engine or the engine itself, thus achieving the ultimate object.

Dublin's New Airport

DUBLIN'S new airport at Collinstown, about five miles from the city centre, is rapidly nearing completion, and it is expected that the formal opening ceremony will take place in May next. Civil aviation operations were transferred to Collinstown on January 19 last, and it is from that airport that Irish Sea Airways are maintaining their service to Britain.

The new airport will be managed by Aer Rianta, Tta, on behalf of the Minister for Industry and Commerce, who will be the controlling authority. Mr. W. McCabe, who was resident engineer on the construction of the airport, has been appointed airport superintendent.

K.N.I.L.M. Annual Report

THE annual report for 1939 of the Royal Netherlands Indies Airways shows an increasing use being made of the company's services despite the outbreak of war. Though tourist traffic from Batavia to Bandoeng and from Java to Bali declined, traffic on other parts of the route showed a more than compensating expansion. The 3,313,920 paying passenger-miles (20,972 passengers) of 1938 showed the considerable increase to 4,013,300 (21,075 passengers). These figures exclude the Java-Australia route, which shows an increased loading in passenger-miles of 30 per cent. per flight.

The carriage of freight showed an expansion of 14 per cent., while the weight of air mail went up by 13 per cent. The frequency of the Batavia-Medan service has been increased to twice weekly, but the Java-Australia route now runs only once weekly due to withdrawal of some Government financial support.

The K.N.I.L.M. fleet consists of five Lockheed 14s and three Douglas DC-2s, all with Wright Cyclone engines, as well as several Fokkers. The company's routes include Batavia, Bandoeng, Sourabaya, Samarang, Palembang, Singapore, Saigon, Pakanbaroe, Medan, Balikpapan, Bali, Macassar, Koepang, Darwin, Townsville, Brisbane and Sydney.

Over the Irish Sea

AER LINGUS, Teoranta (Irish Air Lines) announce a new time-table which commenced on November 25. The normal weekday twice-daily service will operate between Dublin and Manchester as follows:—

DUBLIN—MANCHESTER

Dep. Dublin (by coach), Upr. O'Connell Street, 9.15 a.m. and 1.30 p.m.

Dep. Dublin (by air), Dublin Airport, 10.00 a.m. and 2.00 p.m.

Arr. Manchester (by air), Barton Airport, 11.20 a.m. and 3.20 p.m.

Arr. Manchester (by coach), Midland Hotel, 12.15 p.m. and 4.15 p.m.

Arr. Manchester (by coach), London Road Station, 12.20 p.m. and 4.20 p.m.

Arr. Manchester (by coach), 47, Piccadilly (L.M.S. Office), 12.25 p.m. and 4.25 p.m.

Arr. Manchester (by coach), Victoria Station, 12.30 p.m. and 4.30 p.m.

MANCHESTER—DUBLIN

Dep. Manchester (by coach), Victoria Station, 9.30 a.m. and 12.50 p.m.

Dep. Manchester (by coach), 47, Piccadilly (L.M.S. Office), 9.35 a.m. and 12.55 p.m.

Dep. Manchester (by coach), London Road Station, 9.40 a.m. and 1.05 p.m.

Dep. Manchester (by coach), Midland Hotel, 9.45 a.m. and 1.10 p.m.

Dep. Manchester (by air), Barton Airport, 11.00 a.m. and 2.30 p.m.

Arr. Dublin (by air), Dublin Airport, 12.20 p.m. and 3.50 p.m.

Arr. Dublin (by coach), Upr. O'Connell Street, 1.05 p.m. and 4.35 p.m.

LIGHT ACK ACK

Rifle-calibre Machine Guns for Low-flying Aircraft

THE need for ground defence against low-flying aircraft has necessitated the issue of thousands upon thousands of machine guns of various types, and billions of rounds of ammunition. Although sights are fitted to most of the guns, the use of tracer bullets and "hose-pipe" shooting is considered the most effective.

GAS-OPERATED (above): The Vickers K gun with a rate of fire of 1,100 rounds per minute. Feed is from a circular pan containing sixty rounds.

ENEMY TWIN (right): Twin-mounted 7.9 mm. guns used by the Germans as their standard protection for lorry and troop convoys.

FROM BRNO (below): The Bren gun and mounting on one of our infantry carriers. A direct comparison can be made with the German twin arrangement. The Bren is fed by clips, each containing 30 rounds.

QUARTET (below): A foursome of Lewises cosily mounted on one of our fast motor torpedo boats. The deep pans shown here each contain 100 rounds, while the shallow ones shown in the other pictures have only fifty.

LIQUID-COOLED (above): A belt-fed Vickers gun in a pretentious mounting to protect heavy gun emplacements.

TWO VETERANS OF THE LAST WAR (below, left): A member of the Home Guard takes a refresher course with the Lewis gun at a new angle.

UNCOVERED (below): A stripped Lewis gun as used on trawlers and such-like ships for "hose-piping" dive-bombers and low-fliers

THE INGEN

Additional Details of the Junkers Ju 88 : Poor Armament : Wing Dumping : Anti-Flutter De-Icing Device

Twenty-five thousand pounds of dive-bomber coming down at fifty degrees. The Ju 88 is a bomber redesigned to be a dive-bomber also.

THE description of the Junkers Ju 88 which was given in our issue of October 3 can now be amplified, and many additional features explained and illustrated. The machine which was inspected for the first description was a much-damaged and much-dismantled one, but we have now been privileged, by courtesy of the Ministry of Aircraft Production, to inspect another in a considerably better state of preservation, although completely unairworthy—thanks to the Royal Air Force—and not likely ever to be otherwise.

In the time available since our first article it has been possible to study details which are inventive in character, and each worthy of attention. These are now revealed with drawings for the first time. But, despite the wealth of novel ideas, the Ju 88 does not impress one as an efficient military aeroplane. At best, it might perhaps be called a "near success," but in the grim business of aerial warfare, to miss success by a small margin is little better than being a mile off.

The Ju 88 A-1, the full type name of the aeroplane inspected, though it does not look so big, is about the same size and weight as our Whitley. The idea of a machine as big as this—its total loaded weight is 25,000 lb.—being used as a dive-bomber is one that would not have sprung readily to the mind a few years ago. But this is what the Ju 88 is, as well as being a heavy bomber for bomb-dropping from the level attitude.

The idea of using it as a dive-bomber apparently occurred after it was originally designed—it appeared early in 1938—for the diving brakes under the wings are not capable of retraction, but merely lie flat against the lower surface when not in use. If present in the original conception, it is undoubted that provision for their retraction would have been made. In the guise of a dive-bomber this machine is unique, for it is the only twin-engined example, and the largest, of this type of offensive weapon.

For dive-bombing it has external racks for four 250 kg. bombs, two under each wing, between fuselage and engine. In addition, for level bombing, it can carry 16 bombs, each of 50 kg., inside the fuselage. (The same space inside the fuselage, when cleared of bomb racks, is available for the installation of a large square petrol tank which will be described later.) The total bomb load is, therefore, 1,800 kg. (3,960 lb.).

We are unaccustomed to thinking of big machines doing aerobatics, and, though a pull-out from a dive is not aerobatics, it is capable of imposing a more severe stress on the aeroplane than any other manœuvre if done suddenly at high speed. So it might be thought it would be an insoluble problem to make a machine as big as this strong enough to stand up to the rigours of dive-bombing. But it is a question entirely of speed in the dive; if this is limited to a safe value, then the pull-out can be made without excessive structural loads being applied.

To keep the speed down it is necessary either to limit the angle of dive to something very flat or to provide liberal brakes. Keeping the angle of dive flat renders the machine ineffective as a dive-bomber, since the steeper the angle the greater is the accuracy. So the only possible way, that of making the brakes liberal in size, has been adopted on the Ju 88.

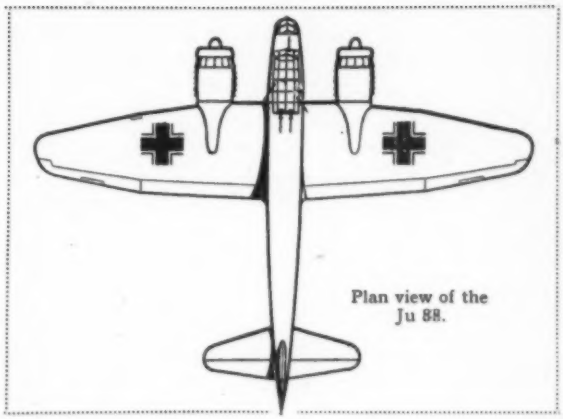
The maximum angle of dive is not certain. One Ju 88 seen had only one diving line on the windscreen, and this was at an inclination of 45 deg. But another one had lines at 40, 50, 60 and 70 deg. The accuracy of dive-bombing at an angle of 45 deg. cannot be very great. It is rather a half-and-half way of doing it, for it has not the

This second article on the Junkers Ju 88 is the eighth of the series on "Enemy Aircraft," the others of which have been:

I	*Modern German Bomber* ..	*Ju 88*	*October 3*
II	*The Messerschmitt Me 110*	*Me 110*	*,, 10*
III	*Germany's Dive-Bomber* ..	*Ju 87*	*,, 17*
IV	*Nazi Fighter*	*Me 109*	*,, 24*
V	*An Inverted Vee Engine* ..	*DB 601A*	*November 7*
VI	*German Radio Equipment*		*,, 14*
VII	*London Raider*	*He 111K*	*,, 21*

ENIOUS JU 88

unkers 88 : Heavy Bomber and Dive-Bomber : De-Icing : Automatic "Pull-Out" : Pressure Devices : Bombs or Tanks Externally



Plan view of the Ju 88.

steady approach of level bombing, and does not give the considerable accuracy and increased penetrating power of a bomb discharged from a bomber descending at an angle of 70 or 80 deg.

The pilot has in front of him a dive-bombing sight of very crude type, though it certainly carries a name which has earned the respect of the world for optical precision work, that of Zeiss. This is quite unlike a level bombing sight, and its most distinctive feature is a parallelogram of wire in the vertical plane, the target being lined up with two of the sides.

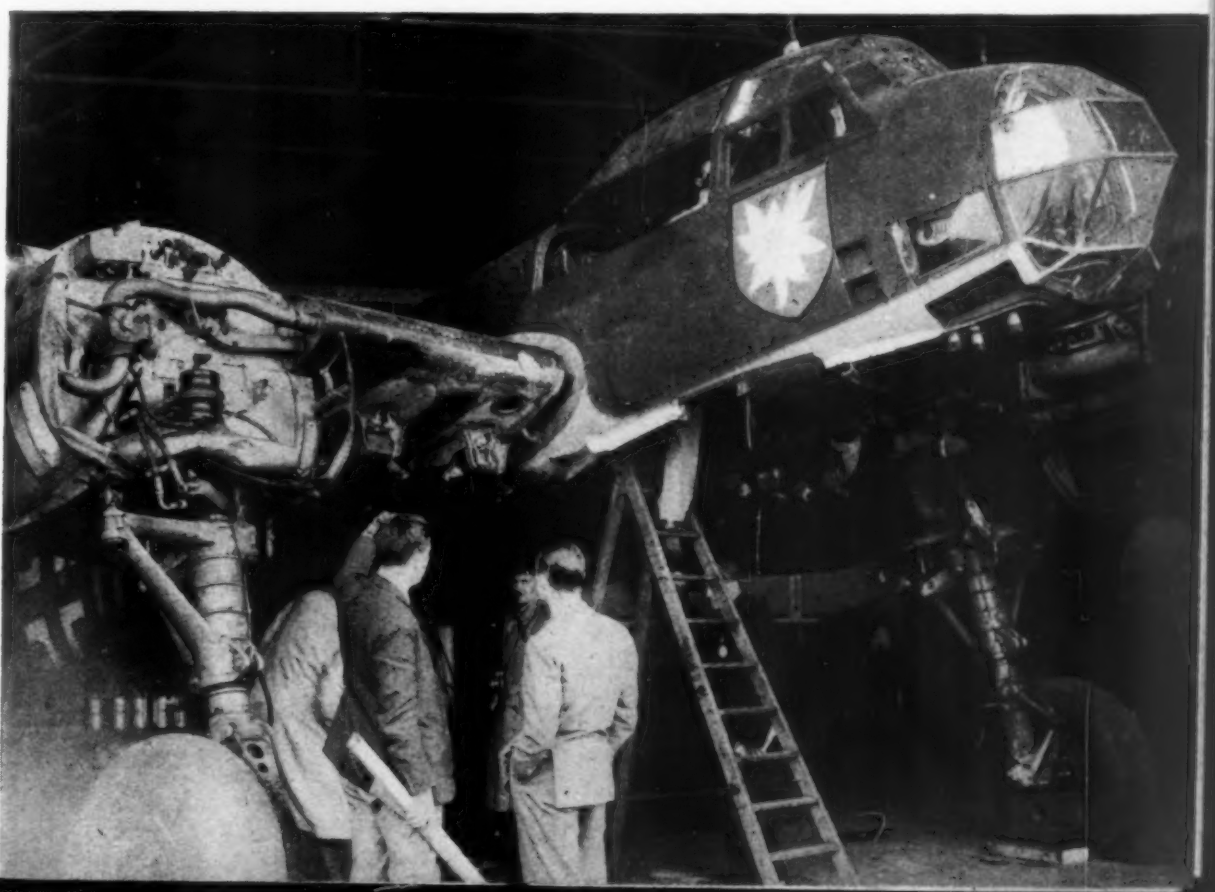
There is a bomb-aimer's position in the nose, but this is probably not occupied during dive-bombing, for to be head downwards during such a descent would be most uncomfortable.

The automatic "pull-out" is a new feature. This name somewhat over-describes the mechanism, as it operates by indicating to the pilot that it is time to pull out, and helps him to do so. Our diagram is a representation of its mode of action. When the diving brakes are lowered and the machine dived, hydraulic pressure is applied to one side of a piston, and so moves the elevator servo tab to the dive position. Then, when the bomb is released electrically, a quick-release is also operated, and the spring in the elevator tab control system endeavours to return the tab to level flight position and so pull out of the dive. Thus the pilot feels the movement of the control column, and is also aided in the pull-out.

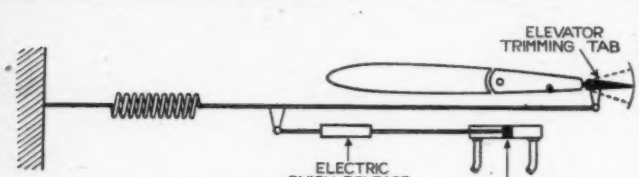
From the aerodynamic point of view the Ju 88 has only one interesting feature. Before explaining this it may be stated briefly that the wing tapers in two straights, and that the Junkers double-wing arrangement of aileron has been abandoned in favour of the slotted type. With the hinge below the control surface the up-and-down movements are accompanied by fore-and-aft ones. When the flaps are lowered the elevators are automatically trimmed. Fin and rudder are single, which reverses Junkers civil practice. This has probably been done for field of fire considerations.

The interesting feature is what is evidently a mass balance weight in the interior of the wing, near the tip. It is arranged to move fore and aft in the horizontal plane with the up-and-down movements of the aileron. Such an arrangement gives an inertia damping on the aileron move-

In this photograph of a partially dismantled Ju 88 the external bomb racks and the fittings for the forward gun can be seen. The massive single-leg undercarriage twists as it retracts backwards. The piping for de-icing the wing by exhaust heat can also be seen. Entrance to the cockpit is by ladder. (Not Hitler with the Contax, but our chief photographer.)

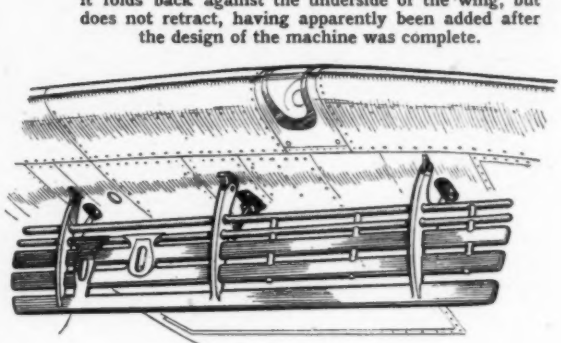


THE INGENIOUS JU 88 (CONTINUED)



(Left) Diagrammatic sketch of the working of the automatic pull-out, which is designed to aid the pilot in pulling out after a dive-bombing attack. Its working is described in the text.

(Below) A diving brake of liberal size is provided under each wing to limit the speed of dive. For level flight it folds back against the underside of the wing, but does not retract, having apparently been added after the design of the machine was complete.



ment from any angular position of that control surface.

Another device not seen on British aircraft, and one which it is hoped we shall never see, is the pedal alongside the control column marked "Ruder Bremse" (control surface brake). By depressing this with his foot the pilot can put a brake on the movement of all control surfaces by hydraulic means. Only one explanation seems possible for this—that it is to damp out incipient flutter.

If this is correct, then the whole flutter problem has been approached from the wrong way. For no aeroplane can be considered a flying machine unless all flutter tendencies are eliminated below a certain placarded speed. Then one simply leaves it to the pilot not to exceed this speed. But to provide him with a brake to guard against flutter in its early stages—it will be useless if the flutter has really started—shows a lack of confidence in the design, and must be somewhat depressing to the pilot.

This may be one of the improvisations which were developed when the Ju 88 was redesigned for dive-bombing work. Possibly it was found that such work involved it in diving speeds above its safe flutter speed. (Being unable to trace out the piping on the first very much damaged Ju 88, this brake pedal was wrongly said to be a parking brake in the earlier article. We take this opportunity of correcting the error.) Our drawing shows the aileron mass balance in the wing, and the corresponding photograph shows also the hydraulic piping leading to the mass balance for the application of the brake.

Stressed-skin Structure

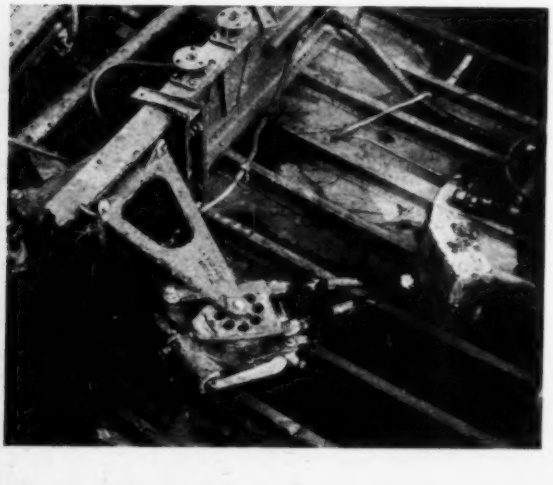
The structure was dealt with in the previous article, and the Junkers predilection for ball joints was mentioned. This is also apparent in the engine mounting, which is the subject of a drawing. Such joints make for easy engine changing. There is also a neat design of ball joint which was found on a rod for actuating a door under the fuselage. As the door opens, the two rods which are joined change their relative attitudes and a self-aligning ball is necessary.

The undercarriage is a massive single-leg structure of clean design. As the leg swings up backwards it is made to rotate and the wheel is turned through 90 deg. to stow flat in the engine nacelle.

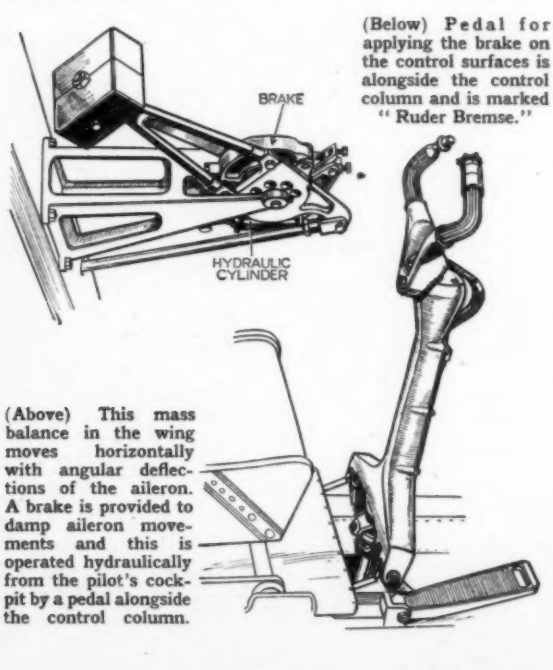
The wing is of orthodox two-spar all-metal stressed-skin construction. The fuselage is made in the same manner as that of the Ju 87; that is, in two halves split along the horizontal diameter. Frames are of Z-section and are set down on the skin and riveted to it. The stringers, which are of "bowler-hat" type, are riveted by two lines of rivets to the skin to form a "closed" section. Small pressed brackets attach the frames to the stringers.

Wing de-icing is done in a manner not seen in British design. Most people are familiar with the pulsating rubber shoe method, and the method by which a chemical is allowed to seep slowly through small holes in a rubber covering on the leading edge. The third method is the smearing-on of a paste. But the system seen on the Ju 88 is that which for a long time has seemed so simple, but its adoption has been held up for reasons which are not altogether apparent.

(Below) This photograph of the mass balance in the wing shows the hydraulic piping by means of which the aileron brake is applied.



(Below) Pedal for applying the brake on the control surfaces is alongside the control column and is marked "Ruder Bremse."



(Above) This mass balance in the wing moves horizontally with angular deflections of the aileron. A brake is provided to damp aileron movements and this is operated hydraulically from the pilot's cockpit by a pedal alongside the control column.

THE INGENIOUS JU 88 (CONTINUED)

After looking at the Ju 88, the reason for non-adoption of the exhaust heat system, for such it is, seem even less apparent. As seen here, it appears to be simplicity itself. Air, taken in behind the engine radiator, is heated by contact with the exhaust stubs and then flows along piping to the leading edge of the wing. Here it enters a D-shaped duct formed by the curve of the leading edge and a vertical piece of sheet metal riveted to upper and lower wing surfaces. In its passage along this duct to the wing tip it heats the leading edge and is then discharged at the wing tip into the interior of the wing, there slightly raising the temperature so that control hinges and pulleys do not freeze at high altitude. A valve is provided to by-pass the flow when not required.

It all seems so simple that one wonders why it has not been adopted before. This system seems to fulfil the three requirements of reliability, simplicity and low weight. But is it effective against the worst icing conditions? —or in face of those icing conditions which may be regarded as the reasonable maximum to be guarded against? If the answer is in the affirmative then there seems little doubt that it is the best de-icing system.

De-icing of the tailplane is accomplished by the Goodrich pulsating rubber shoe method. This has been considered preferable to piping hot air right down the fuselage to the tail.

Air for cabin heating is also taken in behind the radiator and passes through a small water boiler, which is heated by the stub exhaust pipes.

All piping on German aircraft is painted with rings of distinguishing colours in order to avoid maintenance mistakes. Petrol is yellow; oil is brown; engine-cooling fluid is green; hydraulic pressure piping is brown with a red band; compressed air is blue with one red band; the undercarriage system is blue with two red bands; and oxygen is blue with two white bands.

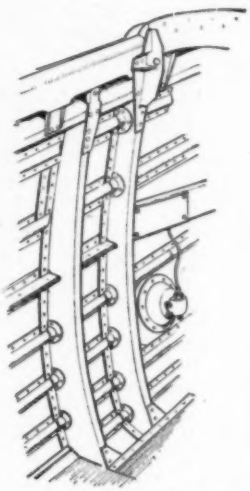
The Junkers self-sealing petrol tank is of non-metallic construction. The inside structure and petrol-retaining shell is an extremely hard synthetic material of fibrous nature, black in colour. Essentially, the casing of the tank consists of five different types of material.

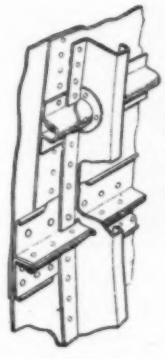
On the outside there is (1) a covering of heavy black vulcanised rubber of smooth surface, about $\frac{3}{16}$in. thick; under that (2) several layers of thin rubber varying from 2 to 6; (3) a layer of soft soluble rubber, very plastic and about $\frac{1}{4}$in. thick; and then (4) a thick layer of good quality chrome-tanned hide. The soft rubber is the essential commodity which provides the self-sealing characteristic of the covering when pierced by a bullet, as the action of petrol causes the rubber to become plastic and swell, rather like half-masticated chewing gum. The puncture is thereby closed. Inside is (5) the thin fibrous casing so treated that it is almost as hard as metal.

The only metal used in the tank are small strips of light alloy distributing the load from the holding bolts to the internal fibre bracing structure. These fibre cross-members support the flat sides and serve to maintain the shape of the tank. The hollow holding bolts, which are all on the top of the tanks, act also as vent plugs. When fitted in the machine the tank is steadied by strong canvas straps. The main fuselage tank accommodates about 250 gals., and is very easy to instal in or remove from the fuselage. The part of the fuselage immediately underneath is removed, and the tank is easily raised or lowered through this space. Without the attachment fittings the weight of the fibre shell with its inner cross bracing weighs 0.57 lb./sq. ft., the total self-sealing covering, excluding the shell, 2.5 lb./sq. ft., that is, a total of 3.07 lb./sq. ft. Complete tanks weigh about 1.5 lb./gal.

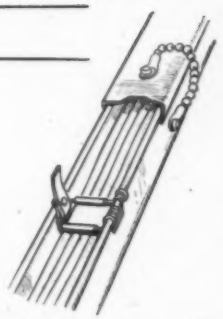
The square fuselage tank mentioned previously has a feature which has given rise to some discussion. A large-diameter pipe (about 5in.) leads out of the top of the tank and along the top of the fuselage right to the tail. There it discharges to the atmosphere, as shown in the drawing.

The fact that the pipe comes out of the top of the tank does not prevent it being a dump pipe, and this is, in fact, its purpose. Pressure is, of course, needed to make the petrol flow out under these conditions, and this is provided by the engine superchargers, an ingenious and, so far as can be ascertained, unique arrange-



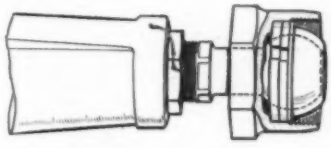


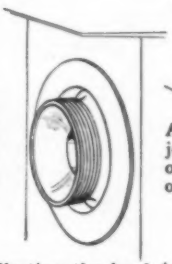
Fuselage construction of the Junkers type has frames of Z section riveted to the skin. "Bowler hat" stringers pass through the frames. The fuselage is made in two halves split on the horizontal diameter.



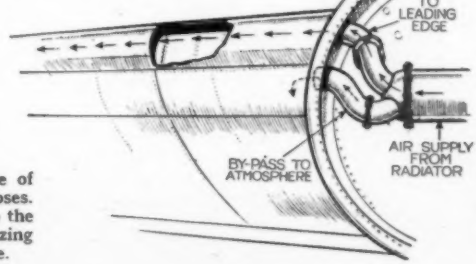
Wiring for the engine installation is very neatly collected into small conduit troughs of aluminium. These have snap-on covers retained by chains, and the wiring is held in position by spring-loaded clips.

(Below) The engine mounting of the Jumo 211B is attached to the structure by very convenient ball joints which make for easy changing.



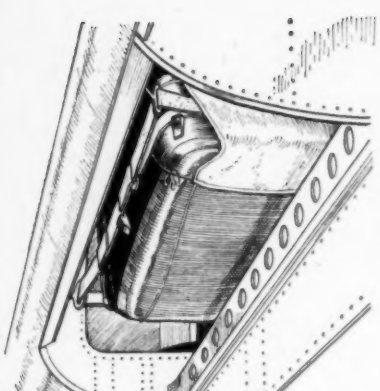


A self-aligning ball joint on a rod which opens and closes a door on the underside of the fuselage.

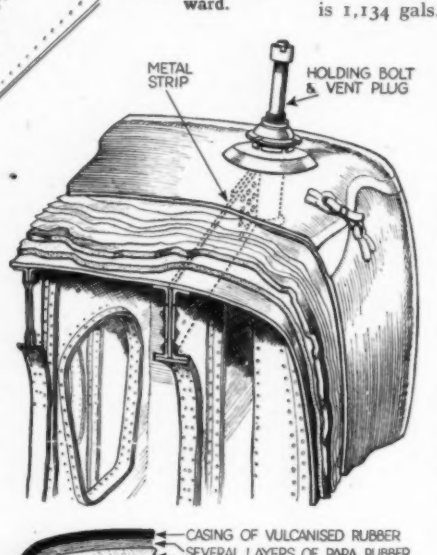


Air, taken in behind the radiator, is heated by contact with the exhaust stubs, and passed along the inside of the leading edge of the wing for de-icing purposes. At the tip it is discharged into the wing space to prevent any freezing of tanks or mechanism there.

THE INGENIOUS JU 88 (CONTINUED)



(Left) The square tank in the fuselage is held in by its six holding bolts on the top surface and steadied by fabric straps. This view is drawn underneath the fuselage looking upward.



(Right) The various layers of leather and rubber which ensure the self-sealing character of the tank are depicted in this drawing. The only metal in the tank is in the small plates which distribute the load from the holding bolts (which are also vent plugs) to the internal bracing members.

ment. Our drawing indicates the method by which this is accomplished.

A valve, operated by an electric solenoid, releases supercharger pressure to the top of the tank and so blows the petrol out of the dump pipe as soon as the diaphragm closing this off has been opened, which is also done electrically.

The question at once springs to mind: Why has not the simpler system of a pipe from the bottom of the tank been adopted, without using supercharge pressure? Speed of outflow is probably the answer. With the petrol flowing out of a pipe from the bottom, the head would vary from about 2½ft. of petrol to nothing when the tank was empty, that is, from 0.8 lb./sq. in. to nothing, an average of 0.4 lb./sq. in. But the supercharger will provide 5 or 6 lb./sq. in. pressure, and this will be maintained right down to the last drop. So the speed of discharge will be increased very greatly. Since the reason for dumping is usually to enable a sudden emergency landing to be made, great speed of dumping is something to be sought for, and this seems to be a way of attaining it.

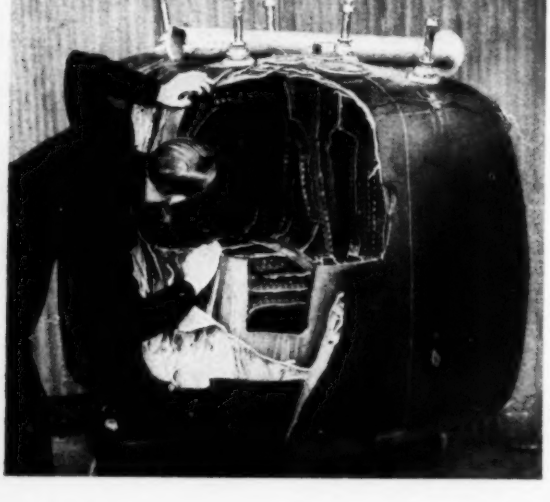
The wing tanks of the Ju 88 contain 324 gals. and the fuselage tank another 250, making 574 gals. But for longer range still, it is possible to attach to the external bomb racks tanks made of plywood containing 560 gals. These tanks can be dumped after they are emptied in order to reduce drag. The total with the bomb rack tanks is 1,134 gals.

Radio is the normal bomber equipment described in our issue of November 14, consisting of communication, DF and blind-approach sets. The Patin master compass is installed in the tail, and has its repeater on the instrument board.

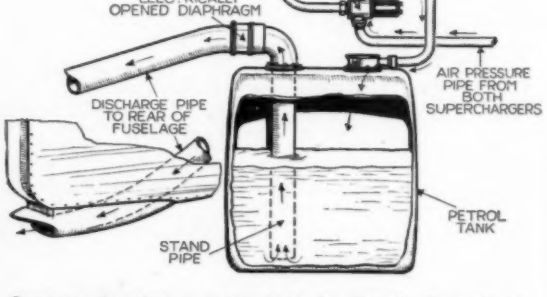
The original armament was three guns, one in the nose and two at the rear firing from the upper and lower positions. This proving quite inadequate, the number has been increased to six in some cases by adding guns through the side windows. The crew is four, and in the cramped cabin it would be impossible to have more. No armour was found on this particular machine, but this is probably not general.

The span is 59ft.; length, 46.5ft.; and mean chord, 9ft. The total loaded weight is 25,000 lb. normally. The engines are two Junkers Jumo 211B inverted vee-twelves, rated at 1,200 h.p. for take-off. These petrol-injection engines were described in *Flight* of January 18.

One cannot but admit to having considerable respect for the ingenuity of individual ideas seen. The whole thing is a collection of numerous "brainwaves," but it is not a good aeroplane, since it has failed in its function. Some of its ideas are ingenious enough to warrant close examination and may perhaps be seen on future machines, if not in their present guise then in some better form. As for the materials in it, they do not give any indication yet of shortage or inferiority, this being also true of the rubber-covered self-sealing tank.



(Left) The internal structure of the self-sealing tank out of the fuselage is seen in this photograph. The system of bracing members built up of fibrous material has become somewhat distorted by the sectioning of the tank.



Pressure-dumping arrangements in the fuselage tank. Pressure from the superchargers can be applied to the tank when the solenoid-operated valve is opened. The simultaneous opening of the diaphragm in the dump pipe allows the petrol to flow away down this pipe to the tail where it discharges to the atmosphere. It is possible that such a system might be used for the laying of a smoke screen from the air.

Air Strategy—XXX

ITALY AS A TARGET—II.

Should Rome be Bombed? Should Ancient Buildings be Spared? Can a Reciprocal Agreement be Reached?

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

SINCE Italy attacked Greece, and since Italian squadrons bombed London, there has been a popular demand in Britain for Rome to be bombed. That demand has been expressed in letters to the Press. I have heard it expressed verbally far more often. "Why should Rome be spared when London is not spared?" people ask.

There may be excellent reasons known to those in high places in Great Britain. The bombing of Rome might mean the bombing of Athens. The whole world would be poorer in the future if these two cradles of civilisation were bombed, for it is impossible to replace the atmosphere which surrounds the edifices of antiquity by modern reproductions, be the reproductions ever so beautifully executed.

I have been in Athens. I have been in Rome. I would grieve as much as anyone to know that the lovely examples which remain of the past glories of these two ancient cities were destroyed by the vandalism of modern war. But—the British Empire is at war. To a great extent sentimentalism in the past is the reason why Britain is at war. The time for sentimentalism has gone. If we are to win this war we must wipe away our tears for the things which have been done and for the things which will be done, and acknowledge, in high places as in humble, that we are fighting ruthlessness.

The people of Great Britain have a right to know why Rome should not be bombed, if indeed that is the official view. And, if Rome is to be spared the horror and desecration of high explosive and incendiary bombs, surely that repression of the right to bomb capital for capital ought to be made conditional upon an equivalent restriction of the activities of the Italian *Regia Aeronautica?*

An Open City

Has Rome been evacuated of all troops; of all Ministries concerned with the prosecution of the war; do no troops or munitions ever move in or out of Rome along the railway lines that run from Roman stations; do no aeroplanes fly over Rome or operate from the aerodromes that lie about the city? These are questions which we have a right to ask if Rome is declared to be an open city. But is that enough?

What is an open city to-day? In warfare of the past an open city was one whose defence would not be contested when an enemy force was at its gates. In those days the fate of the city was decided by the fate of its forces fighting outside the city. There was thus no military object to be gained by the attacking force by subjecting the city to assault; indeed, the value of the tribute which could be levied from the citizens must then decrease by the extent of the damage caused to their property. Does that definition of an open city still hold good to-day? I do not think it does.

Germany and Italy have both ignored the usages of war. They have made total war their fetish. If it is the means by which they hoped to win this war, they must not grumble if it should prove to be the boomerang which brings about their downfall. Since the bombing of London by Italian aircraft, the British Government has reserved its right after taking cognisance of the official Italian announcement of their airmen's attack on London.

In these circumstances it were presumptuous on my part to say whether (in my opinion) Rome ought to be bombed or not. But I do not think it is presumptuous to say that I believe the British public would like to know what special considerations the Government have in mind in regard to the city of Rome. Entirely open and completely undefended towns in Britain have been bombed. Is it any wonder (lacking a word of explanation from a responsible Government speaker) that the citizens of these towns say: "Why are the Romans spared?"

Numerous Military Targets

It is pertinent to say that, whatever may be the situation of Rome to-day, before the war began there were many targets in and around Rome which could undoubtedly be described as military targets. Have these targets been evacuated or converted to other uses? If not, then there is every justification for describing them still as military targets.

The antiquities of Rome are widely scattered throughout the present city, and I am sure that no one in this country or elsewhere would desire to see the noble ruins further defaced by bombs. But there are few cities where the landmarks are more conspicuous than in Rome. Pilots flying over the city would have no difficulty in identifying prescribed targets; they would have no difficulty in identifying the ancient monuments, and by avoiding bombing in their vicinity these monuments would be spared. If such a policy were followed, the people of Rome would be far more blessed than are the people of British cities. For by sheltering in the areas covered by the ancient buildings they would be protected.

That opens up another aspect of air war. If one nation at war were to agree to spare the ancient buildings of an enemy's historic past, and by that agreement were to provide safety cover for the citizens dwelling in the city, the agreement would create (barring accidents) for its inhabitants a safety zone, or series of safety zones, within the city. Surely this provides a basis upon which belligerent Governments might find some kind of solution for the sufferings of dwellers in big cities. Isn't it then time that the British Government made it clear that the sparing of ancient Rome must be contingent upon an adequate *quid pro quo* in the recognition by both Italian and German aircraft of equivalent safety zones in London?

The process can be carried further. Venice was spared in Great War I by the Austrians. D'Annunzio, the Italian poet-airman, led a squadron which showered only leaflets over Vienna. (The facetious said that the Italian aircraft couldn't have reached Vienna if they had been loaded up with bombs; but that is by the way!) The fact remains that Vienna *was* spared. Venice was spared. Indeed, there was a radius around Venice through which none but civilians was allowed to pass. We Britishers who were then stationed on the Venetian plain (having

ITALY AS A TARGET (CONTINUED)

arrived to help the Italians after Caporetto) were not permitted to see Venice either from the air—except at a great distance—or on the ground.

Why hasn't that arrangement been revived? Why do we not inform the Italian Government that historic cities, historic monuments, and buildings containing (or built to contain) works of art of the Great Masters will be respected under a convention which will have for its basis the principle of reciprocity? But that, if there is no reciprocal convention, we shall respect nothing Italian or German, as the Axis partners have respected nothing that is British and in Britain?

Nothing could be fairer than that. It is the equivalent of giving the crew time to take to the boats within the prescribed distance from land, which was the basis of the convention relating to submarine warfare. Germany has disregarded that proviso. And thereby the Hitlerian Germany has been branded before the world. Diplomatically, we can place the Axis in the same position *vis-à-vis* air war. We can give them the choice of three courses:

(a) To agree to a convention respecting certain areas as safe from bombing on a reciprocal basis.

(b) To keep to that convention.

(c) To break it.

At the present time we are using no such diplomatic lever. And by our failure to do so we are placing ourselves in the impossible position of the aggrieved party who refuses to adopt direct methods of redress, and at the same time rejects juridical processes of compromise between the parties.

No Precedent

The military issues of this war can be decided without the destruction of ancient buildings and works of art; they can be decided without wanton attacks upon the civilian population by bombers upon what are, so far as air war *qua* war is concerned, open cities. They are open cities, for in no case is the enemy at the gates, nor does the military situation justify any call to surrender upon the part of the citizens of any of the big cities which are being bombed. Thus there is no precedent for the present situation of *impasse* which the air war has reached in relation to the genuine home territories of the three major participants.

The situation now created by the air war between Germany, Italy and Britain is new and must be recognised as new. It must be dealt with as new. And it demands diplomatic action as well as air action from the British Government. Our diplomatic position is stronger to-day than it has been for years, if we use it aright. No diplomat worth his salt ever sat down (especially in an air-raid shelter) and said to himself: "We can take it." A diplomat says to himself: "He will do it, or he will get it." That is what the British Government ought to be about to-day. And if the enemy does it before he gets it, so much the better for everyone concerned. If it is true that the bully is really a coward (and most people will concede that he is), both Germany and Italy must dread their own process of total warfare being applied to themselves. Then let us use their dread to ameliorate the situation to-day or to clarify our inalienable right to bomb without quarter to-morrow.

What was this Rome whose rulers cunningly declared it an open city before they entered the war? First, it was the seat of the Italian Government. These men who rule Italy were the authors of the Italian declaration of war. I do not believe the Italians that I have known wanted to fight Britain. Then if these men who rule Italy still hold their seats of office in Rome, and we regard their claim to have made of the ancient city an open city, we guarantee them safety to prosecute their designs against the British Empire. That is absurd.

The Four Plaques

In Mussolini's *Via dell'Impero* there is a new wall outside the Forum. The new wall is a clever reproduction of the ancient wall, traces of which still remain on the other side of the stately avenue. On that wall there were, last time I was in Rome, four plaques in white and black marble. Plaque One showed cartographically the early stage of the ancient Roman Empire, with the Roman colonies on the southern side of the Mediterranean Sea. Plaque Two similarly displayed the Ancient Roman Empire at its zenith, stretching far east to the shores of the Caspian Sea, and including England up to Hadrian's Wall. (Not Scotland, mind you!) Plaque Three was the modern Italian Empire when Mussolini took it over. Plaque Four added Mussolini's Abyssinia. Ominously evident was the space reserved on the wall for Plaque Five. This war will decide whether the Italian people will have three plaques or five stuck up on the wall on the south-west side of the *Via dell'Impero*.

Why continue to allow the author of Plaque Four and the would-be designer of Plaque Five to sit in comfort to hatch out his schemes? Have the Germans shown the slightest hesitation in trying to hunt to the death from the air the Royal heads of States upon which they pounced without warning? They have not faltered in their bombing attacks upon Buckingham Palace. Yet there sits Mussolini in safety in his so-called open city.

Is the true definition of an open city to-day to read: A city from which bombing aircraft are shut out by an impenetrable barrage of verbal prevarication and indigenous pretensions to local impotence?

The Italian Air Ministry, the *Ministero dell'Aeronautica*, lies on the eastern side of Rome, not far from the main railway station. Has the Italian Air Ministry been evacuated completely out of Rome? The University City (laid out like a garden city and really very lovely) stands next to the Air Ministry, but the two are quite distinct, and the Ministry is an easy target.

Just to the north of the Air Ministry is a barracks. Has it been evacuated? The railway station I have already mentioned connects Rome with Florence to the north and Naples to the south. The junction lies just on the outskirts of Rome.

Rome's Buckingham Palace

Right in the heart of the city lies, or, rather, rises, the Quirinal, the opposite number to Buckingham Palace. Has it been evacuated? Is Buckingham Palace a defended castle? There is the Palazzo Venezia, Mussolini's headquarters; it shows up perfectly and the huge marble monument to Vittorio Emmanuele II would guide a pilot unerringly to the office of Mussolini.

Across the Tiber at the other side of the Ponte Diferro is the Military College. Further up the river, six bridges up, in fact, is the Ponte del Littorio; there on the right bank of the Tiber are four barracks, all in line along the *Viale delle Milizie*. Are they empty? Further up the river still, but on the other side, is a cavalry bar-

ITALY AS A TARGET (CONTINUED)

racks, close to the grounds of the Villa Cavoia, and easily orientated by a bend in the river and the race-course of the Villa Glori. Is this barracks empty?

Rome was one of the four Italian mainland zones for air organisation. Has this centralisation of air-zone organisation been removed from Rome?

About Rome lie a number of aerodromes. There are the military aerodromes of Centocelle and Ciampino-Nord, and the military seaplane station of Ostia, near the mouth of the river. There are the civil airports of Littorio for landplanes and Lido di Roma for seaplanes. Are they still used for civil aircraft? If not, what are they used for? Not far out from Rome is the experimental and military aerodrome of Montecelio. Alongside it is Italy's Farnborough—the laboratory aeronautical establishment of Guidonia—standing beautifully situated in the shadow of the Appenines.

It is incredible that these aerodromes can be unused. They must play a part, and a not unimportant part, in the Italian air-war effort. Bombing these aerodromes would not be bombing Rome, but the noise of an attack with heavy bombs against these aerodromes would be heard in Rome. It would give the Roman citizen the knowledge that the Royal Air Force were in proximity to his city. That fact might hasten the Italian Government in reaching a decision in regard to a convention defining zones scheduled as immune from bombing.

Rome lies 860 miles from the nearest part of the English coast. That is a long way to carry the heaviest calibre bombs. But Rome lies at the southern end of the three zones into which I divided Italy for target purposes in the article which appeared in *Flight* last week. And that brings Rome and its environs within comfortable striking range of aircraft based on Greek territory. It is 510 miles from one Greek aerodrome, which is not even the most advanced aerodrome on Greek soil. That makes attack on Rome relatively easy. That possibility is one part of the price which Mussolini must have considered (surely with his wisdom?) when he sanctioned or ordered the attack on Greece.

It may be that we have to consider Athens, and the risk of reprisals against the Greek capital, in regard to any attack on Rome. But already the Italians have attacked Tatoi, the Athenian military aerodrome. That allows us to attack the aerodromes around Rome, surely? And as I have endeavoured to show, there are other military targets within Rome itself, unless they have been all evacuated. Surely we ought to seek first to demand that there shall be scheduled zones, for Britain and Italy; but if we cannot reach agreement, how can the Italians expect us to respect their ancient monuments when they have no regard for ours?

FOR GREATER EFFICIENCY

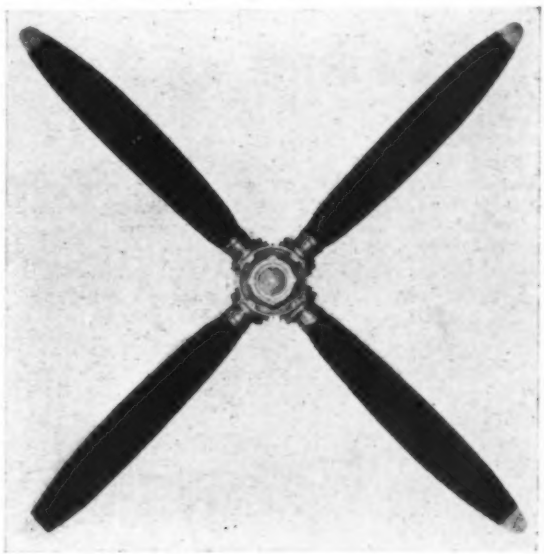
New Rotol Four-bladed Airscrew Introduced : 35-deg. or Feathering

IN the early days of flying the four-bladed airscrew was a fairly common sight, especially on those aeroplanes fitted with engines that had reduction gears. On the direct-drive engines the two-blader was the usual airscrew. The reason for the four-blader was that better efficiency could be obtained with a smaller diameter, and, as undercarriages were fixed in those days, aircraft designers were helped by the four-blader to the extent that a lower undercarriage could be used, thus saving a certain amount of drag.

It might have been thought that in modern times, with retractable undercarriages almost universal, there would not be the same need for four-bladed airscrews. Actually there is, but for rather different reasons. The power of engines has gone up a great deal, and promise to increase still further. The problem of absorbing efficiently the extra power is a very real one. It can be done by increasing the diameter and the blade width, but a limit is set to this line of development by the question of tip speeds. Consequently there is good reason for the four-bladed airscrew for modern high-power engines.

Rotol Airscrews, Ltd., is the first British firm to introduce a variable-pitch airscrew of modern design. In design and operating principle the new four-blader is similar to the well-known Rotol three-bladed airscrews of the 35 deg. and feathering series. That is to say, the pitch of the blades is changed by means of a double-acting cylinder mechanism located externally on the front of the hub. The operation is governed by a constant-speed unit which takes its oil and drive from the engine. This unit is sensitive to variations in engine r.p.m., and, by means of a balance-weight governor and a specially-designed piston valve, controls the flow of boosted pressure oil to the cylinder which moves over a stationary piston.

The blades of the new Rotol may be of improved wood, or of light alloy. The hub is designed on the same lines as that of the three-blader. The blades are mounted in a



double-row thrust ball bearing, and pre-load is applied through an additional row of balls, the race of which is integral with the upper thrust race. This arrangement differs from that of the Rotol three-blader, in which the blades are borne in four-race stacks.

A pitch-angle range of 35 deg. is obtainable, the makers contending that this is sufficient for the fastest fighter, i.e., for the aircraft with the widest speed range. A long-stroke cylinder is, however, available, which will give any desired angle, up to feathering. At present a range of 35 deg. from the fine-pitch setting has been found sufficient to prevent "over-revving" in the fastest dive, during which the blade angle will steadily grow coarser to keep the engine speed at its predetermined lever setting.

HALF OF EVERYTHING

An American's Survey of Orders Placed in the United States

By LEONARD ENGEL

WASHINGTON.

AT a time when what is happening in London is so obviously more meaningful, I have as little desire to write as you have to read about British plane orders in the United States. But American military planes are becoming increasingly important to the United Kingdom, and a survey of the American aircraft industry, particularly as it relates to aid to Britain, is once more urgent. The last three months over here have been both hectic and confusing.

Here is as clear a picture as it is possible to paint at this time. Remember, if some of the facts and figures given are only approximate, that there is not only the censorship in England, but what amounts now to an informal one almost equally severe in the United States, so far as military matters are concerned.

Total U.S. production is fluctuating between 800 and 1,000 a month, light and private planes excepted, of course, but with big transports included along with military machines. In July it was 895, of which 236, according to a published statement by William S. Knudsen, General Motors president who is now in charge of production for the National Defence Advisory Commission, were for the British Purchasing Commission account. August figures show British shipments of 289 planes, although total production was down to less than 850. The September total U.S. output may be somewhat lower still; the American industry is now passing through the stages the British industry went through a year and a half to two years ago. Deliveries to England will range between 300 and 350 monthly for the next two months, rising to 550 monthly early in 1941. It is not expected that they will reach the thousand-per-month level until late next year.

British aircraft orders, which have long since passed the $1,200,000,000 mark, cover just about every usable military type available. Curtiss P-36s. (Cyclones or Twin Wasp engines) are still being taken (they were originally ordered by the French), but completion of the order is due almost at once. Curtiss Tomahawks or P-40s (Allison V-1710) some of which are being delivered, and P-46s (an improved near-400-mile-an-hour P-40) are on order. Deliveries of the P-46 are due to begin toward the end of the year in place of the present P-40s. Lockheed's twin-engined P-38 (Allisons), which does 410 miles an hour despite the semi-official 500 m.p.h. ballyhoo, is also expected to begin rolling in December, from a new Lockheed plant specially built for its production. Several hundred were ordered by the Purchasing Commission.

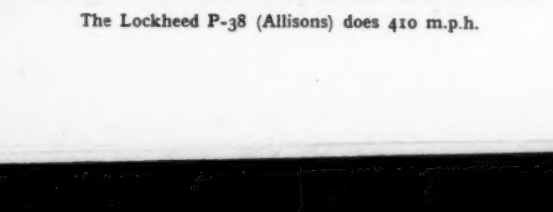
Currently being delivered are export versions of the U.S. Navy's Grumman F4F-3 and Brewster F2A-1 monoplane fighters (both about 320 miles an hour). Not more than a hundred of each type are, however, involved.

The R.A.F. is also likely to wind up with 120 Vultee Vanguards (with Twin Wasp rather than the Double Wasp engines tried in the prototype). The Vanguards were ordered and paid for by Sweden. But, following the invasion of Norway and for fear the planes would fall into German hands, the State Department cancelled the Swedish export licence covering the planes. Now the Swedes would like to sell them. But London is the only

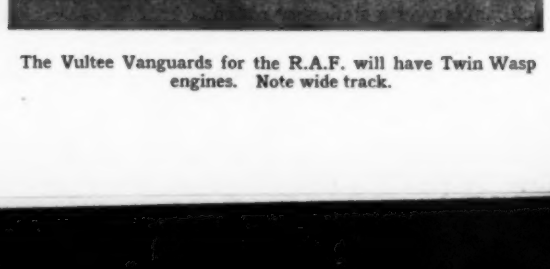
The Grumman F4F-3 has been ordered in small numbers.

The British name for the Brewster F2A-1 is the Buffalo.

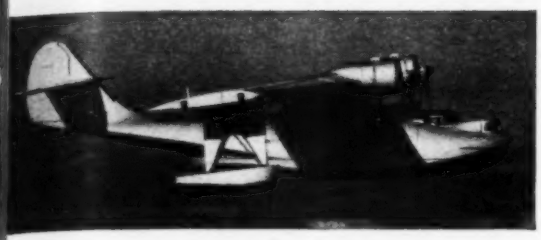
Curtiss P-40 Tomahawks, with Allison engines, are now being delivered.



The Lockheed P-38 (Allisons) does 410 m.p.h.



The Vultee Vanguards for the R.A.F. will have Twin Wasp engines. Note wide track.



Deliveries of the Consolidated PBY will begin about the end of the year.

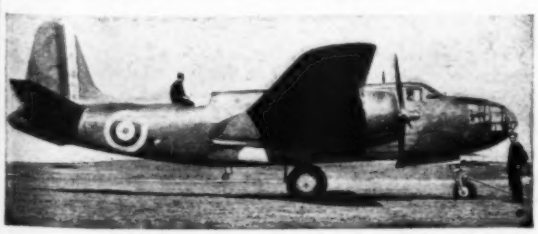
The Consolidated B-24s are not due until 1941.

purchaser and Sweden is scared of Berlin. After all, Nazi-occupied Norway does lie between Britain and Sweden. The planes will probably be turned back to the manufacturer, who will then sell them to Canada or England, anyway. The Wasp-powered Vanguard is in the same class as the P-36, the Grumman and the Brewster.

Lockheed is currently delivering at a 30-to-40-a-month rate an improved version of the Hudson bomber. The new type, somewhat larger, is derived from the Lockheed Lodestar transport in the same way the Hudson comes from the 14. The Lodestar's top speed is about 265 miles an hour. The current improved Hudson order calls for 250 planes altogether.

Delivery of Consolidated PBY twin-engined flying boats, similar to the 28-5 bought by the Air Ministry last year for test purposes, will begin about the end of the year. A very large number of these is on order.

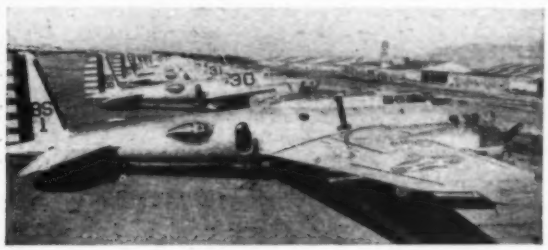
The Purchasing Commission took over a French order for 120 Consolidated B-24 four-motored bombers, but they are not due until 1941. A couple of minor hitches have developed in connection with the large high-winged Consolidated—which has the thin-section, narrow-chord Davis wing—and may have been responsible for some delay. As



Boston is the British name for the Douglas DB-7. Like the fighter on the right, it is equipped with tricycle undercarriage.

designed originally for the U.S. Army Air Corps, it involved three different types of power-driven turrets developed by the General Electric Company and Martin. The commission balked at this pointless variety. (Yes, the United States is getting around to power turrets at last. Army officials are reported here to be considering a British offer of manufacturing rights on the Boulton-Paul turret, as well as sponsoring development of American types.)

Deliveries of Douglas and Martin attack bombers are running to 15 to 20 a month each, and should increase rapidly in the near future. Three slightly different planes are involved in the Douglas orders: 270 Douglas B-7s (two Twin Wasps, 320 m.p.h.), all delivered to France and the order completed; 100 D-B7As, the same plane with G-1200 Cyclones and a little better performance, ordered by



New armament will, presumably, be fitted in the Boeing "Flying Fortress." This picture shows the original American version.

France, but now in process of delivery to the R.A.F.; and the D-B7B. The last is an export version of the Army's A-20 light bomber, minus the new General Electric exhaust-driven turbo-supercharger. The DB7B will have a top speed of 350 miles an hour. (The turbo-supercharged Army plane is supposed to reach 390 miles an hour at 25,000ft.) Nearly 1,000 DB7Bs are on order. About one-third are to be built by the Boeing Aircraft Company under licence. Deliveries of DB7Bs, as well as of Boeing Flying Fortresses, also ordered by the Commission, are not due for some months.

Despite the criticism of the Bell P-39 or Airacobra, the rear-engined tractor single-seater, in *Flight*, and the mechanical difficulties that plague it in the United States, a large order for this model was placed three months ago by the commission.

Deliveries of this will be slow, and for a reason that affects other planes on order as well. The Allison Engineering Company is still beset by the difficulties which have delayed the start of quantity production of the Allison V-170 engine for more than a year.

Dozens of Curtiss P-40 Tomahawks, built both for the R.A.F. and the Army Air Corps, are sitting idle in the Curtiss Buffalo plant, waiting for the engines which come slowly when they come at all.

September production of P-40s, for both customers, is supposed to reach 170. But, in the first ten days of the month, deliveries were at least 75 per cent. below the quota. Although the Curtiss single-seater has been on order for the Army since last fall, so far the Army has been able to equip only three squadrons with the machine.

Tricycle undercarriage and shaft drive are the chief features of the Bell Airacobra.

HALF OF EVERYTHING (CONTINUED)

On top of that, production model Allisons are not turning up the designed power, which is 1,000 h.p. for take-off. It delivers about 100 horse-power less. The designed speed of the P-40, with the Allison expected to turn out the thousand horse, is 360 m.p.h. The plane's partisans claim it reaches 330. Army pilots who have flown it say it is hardly faster than the P-36.

These same difficulties apply, of course, to the Lockheed P-38 and the Bell Airacobra. I suppose the Allison difficulties will be resolved. But time is of the essence.

New Types

Only four new models of importance have turned up since the twin-engined Navy fighter, the Grumman Skyrocket. Three are also naval craft: an inverted gull-winged single-seater monoplane fighter, the XF4U-1, by United Aircraft's Vought-Sikorsky division; the Douglas SBD-1, a monoplane dive-bomber; and the Curtiss XSB2C-1, also a monoplane dive-bomber and successor to the famed line of Curtiss Helldriver biplanes. The XF4U-1 is powered by the Pratt and Whitney Double Wasp (1,850 h.p. at take-off, 1,600 at 20,000ft.). The Douglas dive-bomber is now in production; it is Twin Wasp engined. The Twin Cyclone-powered Curtiss plane is the largest and fastest dive-bomber ever designed for the Navy; its top speed exceeds 300 m.p.h., in level flight, of course.

The basic Seversky (now Republic) single-seat pursuit design has undergone another modification, and with a Double Wasp now appears as the P-47, in which the British Purchasing Commission appears to be taking considerable interest. It may order, particularly if one of the turbo-superchargers now under development for high altitude use is made available along with the plane. The U.S. Army has just let a contract for several hundred P-47s.

The ten-ton Bell Airacuda has been revived in three distinct versions.

The 10-ton twin-engined Bell Airacuda fighter (Allison V-1710's in pusher installations), with which many difficulties have been had, and which had been dropped by the Army, has been revived. Three somewhat different Airacudas are now being tested at Wright Field, and a production order for one of the types is anticipated. The Airacuda was the first plane on which 37 mm. guns, two of them, each firing forward from an engine nacelle, were mounted. Additional armament: Four rifle-calibre machine guns.

In sum, it would appear that, though enormous orders are on the books and British deliveries will approach the thousand-per-month rate, they will not climb materially in the next three months, and will not reach really decisive proportions for at least another eight months to a year.

Further Aid for Roof Spotters

THE Minister of Home Security announces that he is arranging a scheme for supplementing existing arrangements whereby information gained by the Observer Corps about the presence of enemy aircraft is to be made available to roof spotters at selected factories. It is emphasised that the new arrangement should give additional protection and encouragement to workers to carry on after the sounding of the "alert." We are asked to point out that application to be connected with this new service should not be made. Selected firms will be notified as soon as possible.

Aircraft Production

THE December issue of *Aircraft Production* includes the final instalment of a long article dealing with the building of the Airspeed "Oxford" twin-engined trainer, with many detailed illustrations showing its construction. There is also a full-page description of the world's largest bomber, the Douglas B.19, which weighs 164,000 lb. and took 2,000,000 man-hours in its planning and construction. The novel method of mounting the 2,000 h.p. radial engines flexibly in the nacelles is something entirely new in aircraft construction. The protection of magnesium metals is the subject of a technical review, and other articles include the use of cork in aircraft, fluxes for soft soldering, a modern works canteen, and the usual illustrated review of machine tools and shop equipment. *Aircraft Production* is published each month, price 1s. 6d.

Air Freight in America

IT is very evident that a large expansion in the carriage of goods by air will occur in America in the near future. Not only has American Export Airlines bought the Central American airline TACA (Transportes Aeroes Centros Americanos), as was foreshadowed in our issue of November 7, but the United States Freight Company is planning a big development relating to the pick-up and delivery of air freight.

Our contemporary, *American Aviation*, reports that Captain Gill Robb Wilson, president of the National Aeronautic Association, has been appointed air freight consultant by this latter company. His job will be to formulate plans for the use of the freight companys truck fleet in ground transport of the goods carried by air. At present the Railway Express Agency does all this work.

American Export's entry into the Central American field is for two reasons. First, TACA is a very large freighting concern, and, secondly, the acquisition of the company gives Export a flying start in its campaign of competition with Pan American in this area and South America for passenger transport. TACA was started in 1931 by Lowell Yerex, a New Zealand war pilot. During 1940 the company will transport about 30,000,000 lb. of freight, 5,000,000 lb. of mail, and 125,000 passengers. It has 235 airports, with scheduled stops at 125 of them, and operates 40 radio stations. Its staff amounts to 700. It is still using some of the three-engined Fords, but recently bought some Lockheed 14s.

The Automobile Engineer

ALTHOUGH large sections of the British automobile industry are now engaged on aircraft and other work, the personnel is not losing sight of the post-war years, when a return to ordinary conditions will have to be considered. The annual review number of *The Automobile Engineer*, which has just been published, deals to some extent with the war activities of the automobile industry, but it also looks to the future in an important article on design development. Of particular interest is an account of the investigations now being carried out at the research laboratories of the Institution of Automobile Engineers, and engineers will be impressed by the description of the foundry organisation of Morris Motors, Ltd., whose cylinder blocks and heads are produced by the all-core method.

Copies are obtainable from Dorset House, Stamford St., S.E.1, at 2s. 6d.

FLIGHT

BRITISH AIRCRAFT NUMBER

NEXT THURSDAY, December 12th, "Flight" will publish its annual illustrated review of British aircraft and aero engines.

A definite order should be placed immediately with your newsagent.

HERE and THERE

Another Knock for Civil Aviation

IT seems likely that civil aviation will receive a hard knock in U.S.A., as Mr. Stimson, U.S. Secretary for War, has announced that the War Department has asked the Priorities Board to prevent the expansion of the civil airlines so that more productive activity will be available for the manufacture of aircraft for war.

Empire Training

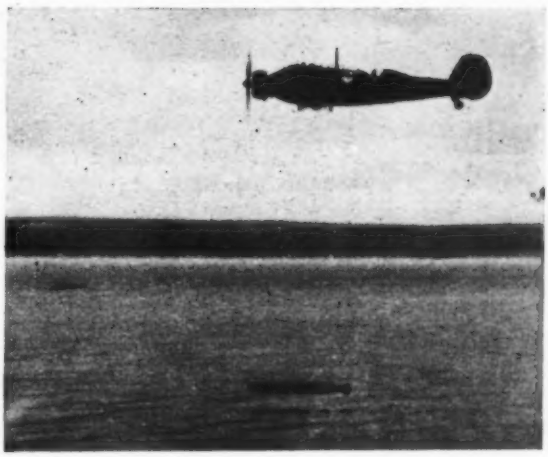
THE first batch of Air Force men trained under the Empire Air Scheme arrived in London on November 25. These men had all been trained in Canada, and most of them came from the central and western Canadian provinces. It has taken some time, nearly a year since the Empire Air Training agreement was signed, for the first fruits of the Scheme to materialise in the form of young and fit men trained to fly and to fight in a war whose first objective must be the maintenance of the democratic way of life.

Trans-Canada Increases

TRANS-CANADA AIR LINES carried 6,337 passengers in September. This was 3,820 more than the same month in 1939, but 724 less than August, due to the shorter month and falling-off in vacation travel. Mail loads aggregated 86,049 lb., a considerable increase over the previous month and twice the 1939 volume. Freight was nearly constant at 12,776 lb. In the three-quarter period the airline carried a total of 38,110 passengers, an increase of 24,078 over 1939. Mail grew from 320,209 to 646,785 lb., and freight grew from 32,410 lb. last year to 75,704 lb. this year.

Fleet Model 60

ANNOUNCEMENT is made by the Department of Munitions and Supply that a contract amounting to $4,065,768 had been awarded to Fleet Aircraft, Limited. It is understood that this contract is for a number of Fleet Model 60 advanced trainers. This model was designed and engineered "from drawing-board to take-off" by Fleet engineers. It is an all-metal low-wing monoplane of modern type with a maximum speed of 191 m.p.h., a cruising speed of 163, and a landing speed of 58 m.p.h. This new contract follows upon a substantial one for primary training aircraft which was received by the company from the Department of Munitions and Supply in January, 1940. Production of the Model 60 has now commenced, the company having recently enlarged its plant. Fleet Aircraft is one of the six Canadian aircraft companies comprising Canadian Associated Aircraft Ltd., an organisation formed for the purpose of manufacturing aeroplanes for the British Government.



Although the Vickers Wellesley was designed as a general purpose machine, few people know that it has been used for dropping torpedoes.

Wright Torque Indicator

THE measurement of power in flight has always been a difficult task and many attempts have been made to provide the ideal instrument for this purpose. It has not yet been possible to design anything which shall be simple and light enough to allow it to be used as a permanent installation for routine flying but various instruments for research purposes have been developed.

One of these is the Wright torque indicator used during the test flying of the Boeing Stratoliner, which is equipped with 14-cylinder Double-Row Cyclones. Power is determined by taking simultaneous readings of speed of rotation and torque. Speed of rotation is given by the rev counter and the real problem has been to measure torque. In the Wright indicator this is done by allowing the external ring gear of the reduction gearing freedom to rotate, with the very slight circumferential movement of $\frac{1}{32}$ inch, and retaining it in position by means of a piston in a cylinder with oil pressure operating on the piston. Thus the problem is resolved into the simpler terms of measuring the oil pressure required to retain the ring gear in position against airscrew torque, and pressure gauges are very sensitive and reliable.

The oil pressure is maintained by an engine-driven pump installed on the governor drive housing. Alteration of oil pressure to keep the piston floating is automatic, the movement of the piston to one end of its travel increasing the pressure acting on it, and vice versa.

Death of Major Kennedy

IT is with profound regret that we have to announce the sudden death of Major D. H. Kennedy, O.B.E., F.R.Ae.S., Hon. Treasurer of the Royal Aeronautical Society for fifteen years. Major Kennedy was well known throughout the aviation world, not only through the R.Ae.S., which has lost a very good friend and an extremely hard worker, but through his connection with the aircraft industry for nearly thirty years. In the last war Major Kennedy served in the R.F.C. and R.A.F., and afterwards went to the Air Ministry, where he was Assistant Director of Supplies from 1917 to 1923.

One of Major Kennedy's daughters married Sir Arthur Whitten-Brown, and he had the great joy of seeing his grandson embarking upon a career in the Royal Air Force.

Thank You, Father Christmas!

THE employees of the Lockheed and Vega aircraft factories at Burbank, California, were going to give enough of their time to build a Lockheed Hudson as a Christmas gift to Britain. The Neutrality Act, unfortunately, prevented this, but the same object is being achieved by these workers subscribing $100,000 in cash for the purchase of the Hudson. As the number of people involved is about 20,000, the average gift is about $5 each, a considerable sum.

This Christmas box is one to remember, and *Flight* says, Thank you, Lockheed and Vega people. Though it would be presumptuous on our part to claim to speak on behalf of even the aircraft workers of Britain, not to mention all the people of Britain, we are quite sure that they say thank you also. It is hoped that the gift will help to bring, though perhaps in a long and roundabout fashion, a season of Peace on Earth and Good Will toward Men.

LONDON PRIDE: Pilots of No. 601 (F) County of London Squadron who have been guarding their own cabbage patch rather jealously of late.

TARANTO

Correctness and Truth of British Official Communiqués Proved by Photographs Taken by The Services

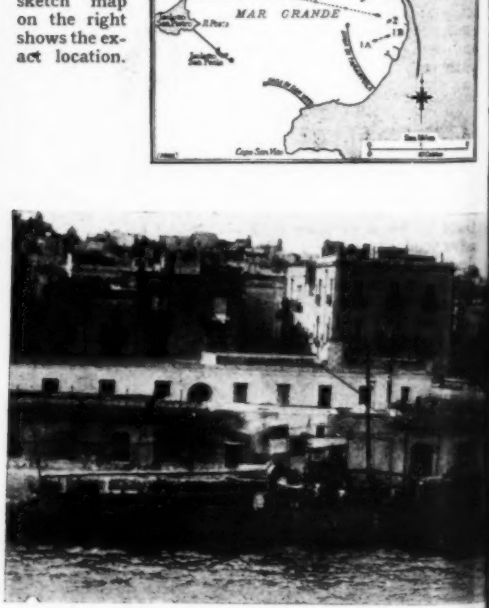
IT is with very great pleasure that *Flight* places on record in these two pages the pictorial documentation of the epic events at Taranto. In our issue of November 21 we told the story of the attack by aircraft of the Fleet Air Arm, operating from the carriers *Illustrious* and *Eagle*, on units of the Italian Navy lying in the harbour of Taranto.

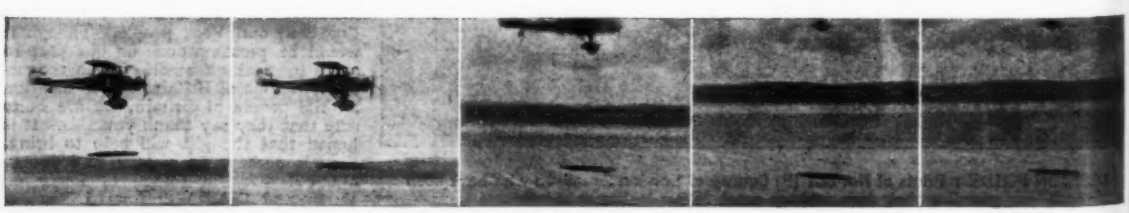
At that time photographs of the scene were not available, but now reconnaissance aircraft of the Royal Air Force have flown over Taranto and have secured some very excellent pictures, a selection of which we publish here.

As we surmised at the time, although it had not then been officially stated, the Fleet Air Arm aircraft used both bombs and torpedoes. The first wave dropped bombs on the ships, and while anti-aircraft guns were thus engaged in high-angle firing (with little effect, incidentally), the torpedo planes came in low and dropped their mouldies at close range. Those were the tactics which "theory" had evolved, but although they had been used on previous occasions in this war, success on such a grand scale had not been achieved. As we said in our issue of November 21, "Taranto will live in history as the classical example of an air attack on a fleet in harbour."

The effects of the air attack can be clearly seen in the photographs, which bear out in a most striking fashion all the claims made by the Official British Communiqués. In the picture below is seen a 23,622-ton battleship of the

(Left) a battleship of the *Cavour* class beached near the east shore of the outer harbour. The sketch map on the right shows the exact location.



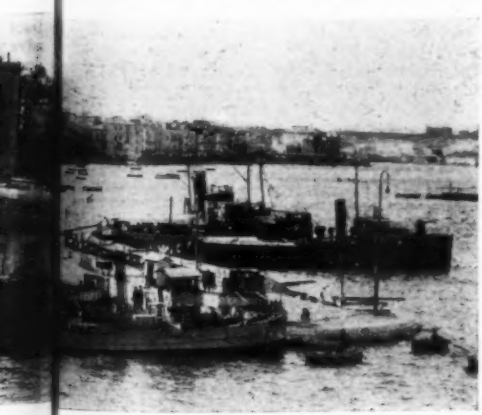


Cavour class. The starboard side is submerged, and oil is leaking on to the surface of the sea. In the top right-hand corner of this picture is another battleship of the same class.

In the picture on the right two damaged cruisers of the *Trento* class are seen in the inner harbour. The location should be compared with that shown in the sketch map.

The strips of photographs, reproduced by the courtesy of British Paramount News, are taken from a ciné film and show successive stages in the dropping of a torpedo from a Fairey Swordfish, a type which did good work in the Taranto action. To make sure of scoring hits, the aircraft approached quite close to their targets before releasing their torpedoes from the low height necessary for obtaining clean running. That our men made the fullest use of the training which they have been receiving for many years is shown by the results obtained.

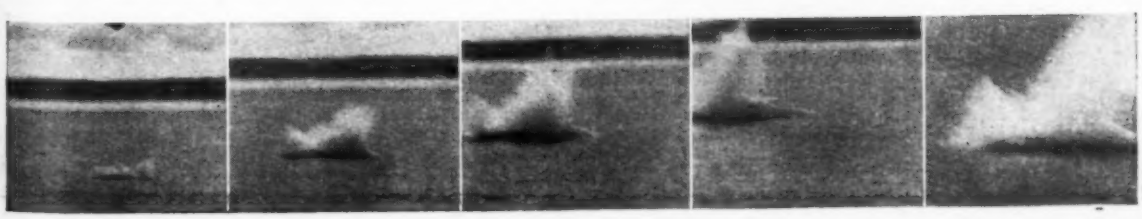
The inner harbour (right) with two damaged cruisers of the *Trento* class (3 and 4).



A view of Taranto Harbour (left) taken before the recent excitement.

(Right) a battleship of the *Cavour* class, down by the bows and beached near the N.E. shore of the outer harbour.

The strip pictures are from a British Paramount News cine film.



CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THE LONG-RANGE BOMBER

A Matter of Fuel

CAPTAIN NORMAN MACMILLAN has called for a bomber specification that is surely calculated to make the most optimistic designer quail visibly before committing himself in any way.

What is the most formidable obstacle standing in the way of the bomber that cruises at 400 m.p.h. for 5,000 miles with 5 tons of bombs? To my mind, it is the enormous amount of fuel required. Let us take the cases of two aeroplanes operating on different fuels in order to demonstrate the overwhelming importance of low consumption:—

		Bomber A	*Bomber B*
	Fuel	"Neohexane"	"Butane"
	Consumption ...	.38 lb./b.h.p./hr.	275 lb./b.h.p./hr.
Weights:	Gross	190,400 lb., 85 tons	125,440 lb., 56 tons
	Empty equip. ...	*119,000* lb.	*78,400* lb.
	Dispos. load ...	71,400 lb.	47,040 lb.
	Fuel	52,500 lb.	29,680 lb.
	Oil	4,500 lb.	3,600 lb.
	Crew of 10	*2,000* lb.	*2,000* lb.
	Military load ...	12,400 lb., 5½ tons	11,760 lb., 5¼ tons
Areas:	Wing	3,900 sq. ft.	2,560 sq. ft.
Loadings:	Wing (gross)	48.82 lb./sq. ft.	49 lb./sq. ft.
	Power (take-off) ...	9.52 lb./b.h.p.	7.84 lb./b.h.p.
Power:	Take-off	20,000 b.h.p.	16,000 b.h.p.
	22,000ft.	16,000 b.h.p.	12,800 b.h.p.
	Cruise, 62½% max. ...	10,000 b.h.p.	8,000 b.h.p.
Speeds:	Maximum	470 m.p.h. at 25,000ft.	
	Cruise, 62½% max. ...	400 m.p.h. at 25,000ft.	
Ranges:	At 400 m.p.h. ...	5,200 miles	5,100 miles

From the above figures, it will be seen that Bomber A is of an excessively large size and that it is highly unlikely that it would attain a speed of 470 m.p.h. even with the surpassing aerodynamic refinement envisaged. On the other hand, Bomber B approaches a reasonable size, considering the load and range called for, and with a cruising power loading of 15.68 lb./b.h.p. is more nearly capable of achieving the desired speed.

For the reasons aforestated, I shall confine myself to the Butane Bomber. The motive power of this latter aeroplane might well include four 4,000 b.h.p. H-32 liquid-cooled engines of a type that I suggested in a letter to *Flight* of January 11th of this year; this engine has the merit of developing about 425 b.h.p. per sq. ft. of frontal area; indeed, the total frontal area of the four engines is only 37½ sq. ft. Dimensions of the H-32 are given below:—

Bore and stroke: 5.5in. and 5in.
Displacement: 62.29 litres.
Power for take-off: 4,000 b.h.p. at 3,200 r.p.m.
Power per litre: 63.9 b.h.p.
Piston area power: 5.52 b.h.p. per sq. in.
Fuel anti-knock rat.: 120.

Despite the extreme compactness of the engines, it would be impossible to submerge them within the aerofoil, which has a maximum root depth of only 3ft. The thickness/chord ratio at root being about 0.143. the root chord will be about 21ft. The structural problem of building a wing with a span of about 180ft. with such a fine taper is another formidable problem.

To pull or to push? that is the question. I rather tend to the opinion that, in an aeroplane of this nature, pusher propellers would present an insuperable problem. Even if they were possible, the increase in weight and reduction in transmission efficiency would offset any advantage gained.

Fuselage design: I think that I should choose a circular section with a fineness ratio of 10, the maximum diameter of the former being 11ft. The undercarriage could only be flush retracted into the fuselage for many obvious reasons. The radiators would be mounted within the wing.

On the subject of fuels for aero engines, it may be of interest if I quote certain information on Butane and Neohexane that appeared in the May number of "Popular Aviation," first tabulating a few of the petrol hydrocarbons:—

Gaseous forms		Liquid Compounds	
Methane	$C\ H_4$	Pentane	$C_5\ H_{12}$
Ethane	$C_2\ H_6$	Hexane	$C_6\ H_{14}$
Propane	$C_3\ H_8$	Heptane	$C_7\ H_{16}$
Butane	$C_4\ H_{10}$	Octane	$C_8\ H_{18}$

The Phillips Petroleum Co. of America has developed Neohexane, "a hydrocarbon fuel composed of molecules containing six carbon atoms in a new and more compact form." With this new fuel, an octane number of 100 is possible without the addition of lead. With added lead, an octane number of 115 is realised. The manufacturers claim that engine power may be increased by 50 per cent. over and above engines rated on 87 octane petrol; the power of the Merlin, for example, would be increased to over 1,500 b.h.p. at high altitudes. I doubt whether the engine would be more heavily loaded than it was originally with fixed pitch airscrew and very high diving r.p.m. Long test flights have been carried out on Neohexane and it will be marketed in small quantities in the near future.

Butane and Propane are used extensively in Germany for commercial and public service vehicles, the "Leuna" gas being a mixture of the former gases. In England, Butane and Propane are used in small quantities for cooking and heating purposes in boats and caravans!! The development of a suitable Butane base fuel, containing Propane, and an inexpensive formula mix for aeroplanes by Mr. H. A. Beilgard, of California, after more than a decade of experimental work, is nothing if not interesting.

Some of the advantages of this new aviation fuel are listed below:—

(1) High anti-knock rating without lead: 120.
(2) Low specific consumption: 0.26 to 0.28 lb./b.h.p./hr.
(3) Optimum pressure rise.
(4) Low cost: 2½d. per gal.
(5) Elimination of ice formation.
(6) Good distribution characteristics.
(7) Elimination of complicated petrol injection and/or carburettors.
(8) Perfect operation in any flying attitude.
(9) Elimination of pumps, strainers, floats, etc.
(10) No dilution of crankcase oil.
(11) Reduction in wear.
(12) Immediate pick-up after prolonged dive with engine throttled well back.

With such a wonderful list of advantages, it is distressing to contemplate the only real disadvantage, namely, the tankage problem. The fuel weighs 5.56 lb. per Imp. gallon, and Mr. Beilgard uses a ball tank to resist the exerted pressure of 40 to 50 lb./sq. in. according to outside temperature. Personally, I favour a light-gauge stress-carrying spar tank of circular section and having a large number of separate compartments. Bullets would tend to be deflected off the spar, and the possibility of a large number of sections being affected would be remote.

JOHN W. MORRISON.

London, S.W.3.

THE SLIP-WING SCHEME

Design for Alighting on Water

THE performance figures for Mr. Pemberton-Billing's long-range bomber illustrate in a most striking manner the great advantages to be derived from a change of operational technique as distinct from mere improvements in design. The high speed and the very large proportion of disposable load are made possible, not because of the unorthodox arrangement of the propulsion units, or because Mr. Pemberton-Billing has discovered a more efficient aerodynamic form, but because he has avoided the restriction normally imposed on wing-loading by the take-off condition by the use of assisted take-off.

I have frequently stated the view that assisted take-off, as such, solves only half the problem of high wing-loading. There is needed also some means to enable alighting to be effected safely at high speeds. The consequences of failure to solve this latter half of the problem is shown by the control difficulties inherent in the P.B. 49. Although the landing case is made easier by the fact that the wing-loading is then reduced to little more than a third of its maximum value, it is still necessary to provide controls of adequate size for the landing speed. Controls of this size will be almost immovable at the high end of the speed range. Had Mr. Pemberton-Billing designed his bomber to alight on water, a far higher alighting speed could have been tolerated, and hence this difficulty avoided.

Mr. Pemberton-Billing's method for assisting take-off is a variation of the Mayo Composite scheme, having, however, the disadvantage that the whole weight of the combination is borne upon the tricycle undercarriage of the operating machine. This undercarriage is stated to weigh 2,000 lb., that is, about 4.2 per cent. of the weight of the combination. Now, the tricycle undercarriage has received more development in U.S.A. than in this country, yet the tricycle undercarriage of the D.C.4, which can be considered one of the best examples of current U.S. design, and which, moreover, is designed for an initial wing-loading considerably lower than that of the P.B.49 when landing, weighs 6.2 per cent. of the gross weight.

CORRESPONDENCE (CONTINUED)

It seems that Mr. Pemberton-Billing has succeeded in designing an undercarriage for a specially arduous job at a cost in weight of about 50 per cent. under the best American practice. This is quite a useful achievement, since an undercarriage serves no useful purpose whatever in flight; but a hull designed to alight on water might have reduced this parasitic weight to the irreducible minimum.

Like other protagonists of auxiliary aircraft for assisting take-off, Mr. Pemberton-Billing lays great stress on the fact that release is to be effected "at a safe height." It is necessary that he should stress this feature, since it is the only semblance of an advantage which the method possesses over surface launching to offset the disadvantages of an enormous amount of handling, and slow and costly operation. Actually, the risk of engine failure during take-off is very small with modern engines and multiple power units. It is decreased still further by the use of auxiliary power to accelerate to flying speed—thus avoiding that condition of engine overload euphemistically termed the "take-off rating." The risk is reduced to vanishing point if the take-off takes place over water and the aircraft hull be designed specifically to alight upon water at very high speeds. So far from it being "criminally dangerous" to launch from the surface under such conditions, I would suggest that this term is better reserved for the practice of sending land aeroplanes on long journeys over the sea, where there is little hope of salvage in the event of being forced down, and over enemy territory equipped with a vulnerable alighting gear whose derangement may mean the total loss of the aircraft and a ghastly death in blazing petrol for the crew in attempting to land at their own base. The nose wheel of a tricycle undercarriage adds 50 per cent. to the area of an already vulnerable component.

It is difficult to criticise details of Mr. Pemberton-Billing's scheme because the details are not there, although the Editor has been kind to him in the matter of space. The method by which the operating aircraft is to be held and released is not disclosed, nor is there any mention of a convenient way of hoisting the 1,000 sq. ft. "glider" into position above the bomber. The problem of launching a squadron of bombers, either simultaneously or at short intervals, is not discussed. On the general question of the desirability of such a long-range machine where the fuel load of necessity greatly exceeds the bomb load, one cannot help feeling that the development of an efficient water-operating type is better policy for a nation having command of the sea, because then all bombing may be of the short-range variety. The legend of the superior mobility of land types is interred in Norway.

I am in most hearty agreement with Mr. Pemberton-Billing in that only through assisted take-off can any major improvement in aircraft performance be obtained.

F. W. KING.

New Malden.

Speed or Armament ?

HAVING read the two recent articles by Pemberton-Billing, and by reason of me being non-technical, I have been moved (even as I believe the Editor of *Flight* has been) to raise my hand to strike for Pemberton-Billing, as doubtless others will be doing. However, it is hard to raise one's hand against something intangible; it is hard to argue against the objection of the Government when the objection is not clear.

Assuming it is the question of armament. High speed or heavy armament as a policy for bombers seems to be the best, providing there is *no* compromise between the two. British policy has been that of heavy armament. German policy has been a compromise; the result is known. For either policy to be successful the bomber must be equal or superior to the enemy in either armament or speed.

The heavy armament of British bombers appears to have been, with a few exceptions, superfluous during night attacks on Germany. With high speed, contacting of bombers by fighters at night becomes still more difficult. If high speed and heavy armament can be obtained *without* compromise to either, so much the better.

If bombs are carried in one aeroplane and guns in another the highest maximum speed is attainable. Not only so, but the armament may be varied to suit the occasion, and need never be superfluous.

I have reason to believe that we possess already a twin-engined fighter, heavily armed and with a maxium speed approaching that of P.B.29. The demonstration flight of two twin-engined aeroplanes before the meeting of the M.P.s may be remembered. It may also be remembered that there appeared in *Flight* some time ago a report which read something like this: "Britain is experimenting with a twin-engined fighter capable of 430 m.p.h. and believed to be designed by Westlands."

It can, of course, be said that the Germans have failed to provide adequate protection by their use of large escorts. Me 109s and Me 110s have their main armament directed forwards, and in order to return the fire of attacking fighters have to leave their charges. A fighter equipped with a power-operated gun turret could be included in a small formation of bombers, and would never have to leave that formation.

No amount of money given to the "Spitfire Fund" will increase the production of Spitfires. What is more urgent is a "P.B.29" fund to help prevent a worse evil than inflation.

Bristol. DAVID S. JACKSON.

WE often read and hear the doctrine that "speed is the best defence of the bomber."

That this is only partly true is easily seen by considering Mr. Pemberton-Billing's bomber, described recently in *Flight*. It it hoped to escape the attention of fighters by achieving a top speed in the region of 450 m.p.h.

Now surely this machine could easily be turned into a fighter! With the same wing, engines, and tail unit, but with a thinner fuselage, less fuel, equipment and crew, and no bomb-load, a modified machine would have a considerably higher speed than the bomber and would hence have a decisive advantage over it. It is clear, therefore, that, however fast a bomber can be made, a fighter can be made faster.

It seems, therefore, that all which can be claimed for a very fast bomber is that if it is faster than existing fighters it will be able to bomb almost unopposed until a modified version of itself is produced to attack it. This temporary advantage is naturally of great value and would fully justify the production of this type of bomber.

A. G. SMITH, B.Sc.

Swanland, E. Yorks.

I HAVE been very interested in Mr. Pemberton-Billing's recent articles on the prospects of the assisted take-off bomber. But may I, as one with no experience of aircraft design, suggest that, even if his progeny would do all he claims—and there appears to be no reason why it should not—his fundamental conception is incorrect and that his *magnum opus* would fail as a military weapon.

It relies for its success on immunity from attack due to speed. But surely the answer to the assisted take-off bomber would be the assisted take-off fighter. As its range could be shorter, it could have a greater power loading and maximum speed on a similar or slightly reduced wing loading. Its manœuvrability would be at least as good as that of the bomber, while it would rely for its attack not on its mobility *in toto*, but on mobility of fire power.

With comparatively long-range cannon firing hydraulically operated turrets, fighter patrols maintained above vital districts would find these unarmed and unarmoured bombers an easy target.

With their disposable load of fuel and cannon shell they do not seem to present any difficulty with respect to take-off and landing, which is not exactly paralleled and presumably surmounted in the bomber, while problems of suitable design of control surfaces, or even of mechanical assistance in control mechanisms, if they can be overcome for the bomber, can surely also be surmounted for the fighter.

Unless there is a fallacy in this argument it does look as though military success might escape the "Billing Bomber," though doubtless to be replaced in more peaceful times by laurels for the "P.-B. slip-wing air liner."

C. T. NANCE, B.A.

THE INDEPENDENT OPERATORS

Very Much Alive

WE notice that reference has been made in the technical papers to the fact that the only air transport companies surviving to-day are those of the railway group. This is, of course, the case in so far as aircraft operating is concerned, but I should like to point out that most of the group of independent operators are very much alive to-day and doing a job of work of national importance.

When their aircraft were taken from them most of the companies put their personnel, experience, and equipment at the disposal of the Ministry of Aircraft Production, my own company among them.

It is their firm intention, when the time arrives, to endeavour to re-establish their air routes and services once more.

You will note from this heading that this company also continues to retain its London office.

For North Eastern Airways Ltd.,
FREDERIC C. R. JAQUES, Managing Director.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

More R.A.F. Comforts Needed

WITH the approach of winter there is an urgent demand for woollen garments for the fighting men of the R.A.F. The most immediate need is for the airmen who have been sent to Greece to support the Greek offensive against the Italians. Several thousands of woollen comforts are wanted for this theatre alone.

Allowance Branch Moves

THE Department of the Air Ministry dealing with the payment of allowances and allotments to wives and dependants of men serving in the Royal Air Force has moved from Tetbury to Worcester. Correspondence in connection with these allowances and allotments should in future be addressed to: The Director of Accounts, Air Ministry, Redhill, Worcester.

R.N.V.R. Fleet Air Arm Officers

WELL-EDUCATED men between the ages of 18 and 28 are required for pilots and observers in the Air Branch of the R.N.V.R. The following are eligible to apply:—

Men who have not yet registered.

Men who have registered and expressed a preference for service in the Royal Navy or Royal Marines, but have not yet been posted.

Men who have registered and who have been allocated to the Army or R.A.F., but who have not yet been attested for service in those Forces. Applicants in this category should immediately notify the Ministry of Labour Office at which they have registered, that they now wish to serve in the Royal Navy. Their applications for the Fleet Air Arm cannot, however, be proceeded with if they are called up for service in the Army or R.A.F. before their selection for the Fleet Air Arm is finally decided.

Applicants must have attained a general standard of education equivalent to that of the School Certificate, and must pass a medical test requiring a high standard of physical fitness. They must be prepared to serve either as Pilot or Observer, as required.

Further particulars may be obtained from the nearest Combined Recruiting Centre, the address of which can be obtained from the local Ministry of Labour Office, or by application to the Secretary of the Admiralty, London, S.W.1, in writing.

Awards

THE KING has been graciously pleased to approve the following appointments and awards in recognition of gallantry displayed in flying operations against the enemy:—

The number after each name indicates the squadron with which the recipient is serving.

COMPANION OF THE DISTINGUISHED SERVICE ORDER.

Squadron Leader Hugh Lockhard Maxwell, No. 18.

BAR TO THE DISTINGUISHED FLYING CROSS.

Acting Wing Commander John Nicholas Haworth Whitworth, D.F.C., No. 10.

Acting Flight Lieutenant John William Stephens, D.F.C., No. 102.

DISTINGUISHED FLYING CROSS.

Wing Commander Sydney Osborne Bufton, No. 10.

Squadron Leader Stanley Sinclair Bertram, No. 99.

Squadron Leader James Ellis McComb, A.A.F., No. 611.

Squadron Leader Wynne Somers Goodrich Maydwell, No. 53.

Acting Squadron Leader John Stuart Bartlett, No. 58.

Acting Squadron Leader John Noel Mahler, No. 15.

Acting Squadron Leader Douglas Parker, No. 44.

Acting Squadron Leader Richard Kemp Wildey, No. 78.

Flight Lieutenant John Leighton Beck, No. 214.

Flight Lieutenant Roderick Hugh McConnell.

Flight Lieutenant Louis Douglas Wilson.

Acting Flight Lieutenant Richard Sydney Edward Aldridge, No. 61.

Acting Flight Lieutenant Charles Brian Best, No. 40.

Acting Flight Lieutenant Clair Mansell Maybury Grece, No. 59.

Acting Flight Lieutenant Thomas Michael Horgan, No. 16.

Acting Flight Lieutenant Frederick John Lucas R.N.Z.A.F., No. 75 (N.Z.).

Acting Flight Lieutenant David Stewart Robertson, No. 78.

Acting Flight Lieutenant Derek John Aubrey Roe, R.A.F.O., No. 107.

Acting Flight Lieutenant Patrick John Shaw Shaughnessy, No. 50.

Acting Flight Lieutenant Edward Joughin Sheeran, No. 115.

Acting Flight Lieutenant John Aloysius Siebert, No. 44.

Acting Flight Lieutenant Theophilus John Scott Warren, No. 107.

Flying Officer Ernest Reginald Baker, No. 210.

Flying Officer Terence Malcolm Bulloch, No. 206.

Flying Officer Dennis Hayley-Bell, No. 269.

Acting Flight Lieutenant John Colpoys Breese, No. 82.

Flying Officer William Maxwell Nixon, No. 10.

Flying Officer George Edward Walker, No. 58.

Pilot Officer Hubert Percival Clark, No. 44.

Pilot Officer Terance Gerard Hynes, No. 44.

Flying Officer Swain Moxham, No. 50.

Flying Officer William Denys Butterworth Ruth, No. 50.

Flying Officer William Maurice Chalk Williams, R.N.Z.A.F., No. 75 (N.Z.).

Flying Officer John Douglas George Withers, No. 83.

Acting Flying Officer Edward William Bitmead, R.A.F.V.R., No. 115.

Acting Flying Officer Charles Thorley Kimber, No. 110.

Pilot Officer John Parmella Balfour, No. 201.

Pilot Officer Charles Raymond Brown, R.A.F.V.R., No. 101.

Pilot Officer Ian Morgan Rutherford Brownlie, No. 77.

Pilot Officer James Campbell Cairns, No. 10.

Pilot Officer Edward William Deacon, No. 51.

Pilot Officer John Richard Denny, No. 78.

Pilot Officer George Arthur Litchfield Elliott, No. 77.

Pilot Officer Cecil Victor Fraser, No. 115.

Pilot Officer Robert Stewart Gilmour, R.A.F.V.R., No. 15.

Pilot Officer Reginald Charles Harbourne, No. 44.

Pilot Officer Donald Joseph Harkness, No. 75 (N.Z.).

Pilot Officer Walter Ralph Haskell, No. 49.

Pilot Officer John Lewis, No. 49.

Pilot Officer James Alexander Little, No. 83.

Pilot Officer Joseph Laurence Moore, No. 115.

Pilot Officer Edward Donald Parker, E.G.M., R.A.F.V.R., No. 49.

Pilot Officer Victor Fernley Baker Pike, No. 58.

Pilot Officer Graham Voice Ridpath, No. 44.

Pilot Officer Donald Neil Robinson, No. 38.

Pilot Officer William Michael Ronald Smith, No. 44.

Pilot Officer Keith James Somerville, No. 10.

Pilot Officer Peter Wynn Mason West, No. 50.

BAR TO THE DISTINGUISHED FLYING MEDAL.

Sergeant Ernest William Gimson, D.F.M., No. 107.

DISTINGUISHED FLYING MEDAL.

Flight Sergeant Dennis Henry Allan Moore, No. 58.

Flight Sergeant Christopher Arthur Saunders, No. 61.

Sergeant Peter Alderson, No. 15.

Sergeant Alfred George Bake, No. 50.

Sergeant William Charles Baker, No. 15.

Sergeant George Robert Birt, No. 44.

Sergeant Cyril Denys Boothby, R.A.F.V.R., No. 58.

Sergeant Thomas Henry Joseph Cairns, No. 50.

Sergeant John Donnelly, No. 50.

Sergeant Robert John Ellis, No. 75 (N.Z.).

Sergeant Walter Ellis, No. 49.

Sergeant Charles Frederick Fennel, No. 49.

Sergeant David Gallanders, No. 51.

Sergeant Leonard Roy Gould, No. 75 (N.Z.).

Sergeant Harold Gregson, No. 51.

Sergeant Alfred Adair Griffin, No. 51.

Sergeant Douglas Haigh, No. 107.

Sergeant Maxwell Ronald Harvey, No. 58.

Sergeant Wilfred Stanley Herring, No. 44.

Sergeant Rowland Noel Holland, No. 18.

Sergeant Kenneth Hugh Leslie Houghton, No. 83.

Sergeant Kenneth Turner Howarth, No. 40.

Sergeant Robert Henry Hughes, No. 75 (N.Z.).

Sergeant William Charles Browne Jesse, No. 58.

Sergeant William Jessop, No. 15.

Sergeant John Lawson, No. 233.

Sergeant Godric Loughlin, No. 101.

Sergeant Robert McCormack, No. 83.

Sergeant William McCormick, No. 50.

Sergeant Harold Mee, No. 50.

Sergeant Graham Mackinlay Neeson, No. 51.

Sergeant George Duff Nisbet, No. 83.

Sergeant William Hugh Parkin, No. 115.

Sergeant Hubert Everard Preston, No. 44.

Sergeant David Roberts, No. 53.

Sergeant Edward John Sayer, No. 83.

Sergeant Cecil Smith, No. 44.

Sergeant Eric Lester Smith, No. 50.

Sergeant Harold Walter Stone, No. 58.

Sergeant John Wood, No. 50.

Acting Sergeant Ronald Cuthbert Besant, No. 51.

Acting Sergeant Gordon Collis, R.A.F.V.R., No. 101.

Acting Sergeant Jack Dunthorn Laurie Hall, No. 51.

Acting Sergeant Robert Frank Pavely, No. 15.

Sergeant Douglas Alfred Ernest Hayhurst, No. 83.

Sergeant Gavin Allan McCreary, R.A.F.V.R., No. 40.

Sergeant Kenneth Newton, R.A.F.V.R., No. 40.

Sergeant Herbert Henry Williams, No. 82.

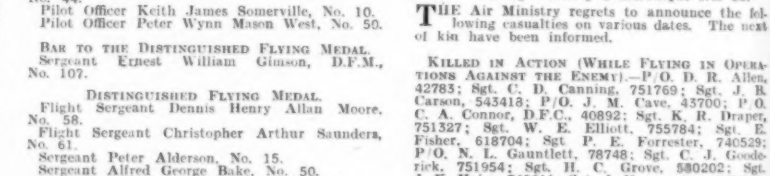
Leading Aircraftman James McCutcheon, No. 102.

Roll of Honour

Air Ministry Casualty Communique No. 53.

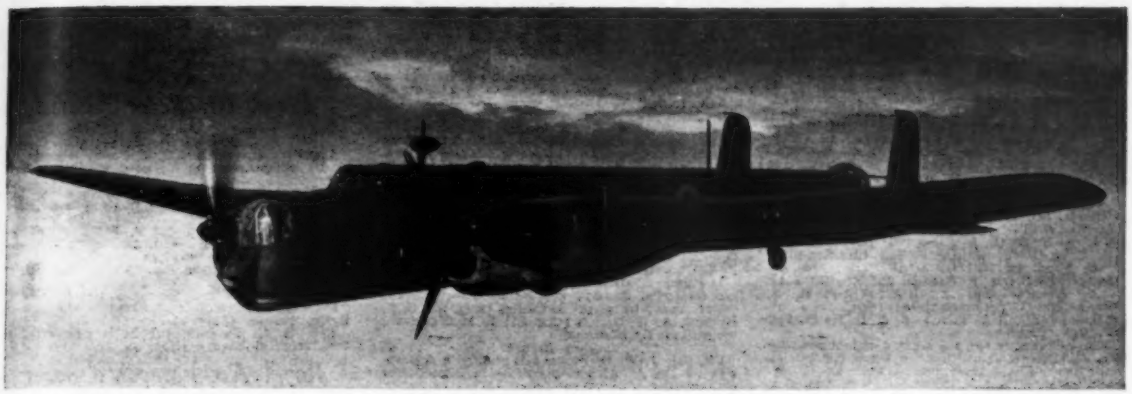
THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed.

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—P/O. D. R. Allen, 42783; Sgt. C. D. Canning, 751769; Sgt. J. R. Carson, 543418; P/O. J. M. Cave, 43700; P/O. C. A. Connor, D.F.C., 40892; Sgt. K. R. Draper, 751327; Sgt. W. E. Elliott, 755784; Sgt. E. Fisher, 618704; Sgt. P. E. Forrester, 740529; P/O. N. L. Gauntlett, 78748; Sgt. C. J. Goodenick, 751954; Sgt. H. C. Grove, 580202; Sgt. J. K. Haire, 748611; Sgt. J. Hammerton, 745227; Sgt. A. W. Hay, 519077; Act. Sgt. J. G. Hitchen, 937501; Sgt. R. D. Hogg, 754041; Sgt. J. J. Jackson, 746821; Sgt. W. V. Jaggs, 745515; Sgt. E. Kenny, 968455; Sgt. R. Lauder, 507615; Sgt. C. McCulloch, 745703; Sgt. S. R. Merrett, 746888; A/C.2 G. A. Mangle, 973249; Sgt. R. Norris, 751289; Sgt. A. D. Page, 745566; P/O. A. J. R. Pate, 79171; Sgt. R. W. J. Phelps, 644168; Sgt. D. P. Rawlings, 526314; Sgt. T. H.



PUBLIC-INFORMER: Air Marshal Sir Philip Joubert at a luncheon, given by the Islington Chamber of Commerce, where he spoke on the subject of night bombing. His excellent diction and knowledge of his subject has made him a popular radio speaker on the war in the air.

SERVICE AVIATION (CONTINUED)



FULLY FLEDGED : A Merlin Whitley flying on one engine with the Rotol airscrew of the stopped engine in the fully feathered position. This manner of lowering the head resistance of an engine which has been put out of action may turn the scale between safety and disaster.

Sansum, 902416; P/O. A. O. L. Stevens, 74967; P/O. J. Tillett, 33454; Sgt. G. E. Turner, 745245; Sgt. T. R. Woor, 744940; Sgt. S. A. Wormald, 758099.

PREVIOUSLY REPORTED "MISSING BELIEVED KILLED IN ACTION," NOW PRESUMED "KILLED IN ACTION."—Sgt. N. W. Brown, D.F.M., 518807; Sgt. J. Dowds, 632780; Sgt. W. E. Neville, 631165; P/O. J. J. Tarlinton, 40763.

PREVIOUSLY REPORTED "MISSING," NOW PRESUMED "KILLED IN ACTION."—F/O. L. G. Bowler, 39431; A/C.1 P. W. Chalmers, 619757; A/C.2 R. M. G. Clark, 618202; Sgt. P. Chivers, 741732; P/O. G. L. Crosby, 40679; Act. Flt. Lt. M. S. Donne, 33186; P/O. C. Edmunds, 75997; L.A/C. A. J. P. Golder, 522805; A/C.2 H. Greggans, 641163; Sgt. N. J. Griffin, 563663; Cpl. O. Haire, 567057; P/O. R. G. N. Harmston, 41845; F/O. G. Harries, 39520; L.A/C. H. Hatton, 531631; P/O. C. R. Hebeler, 40390; Sgt. J. R. Ibbotson, 580861; Cpl. L. D. Isaacs, 800520; Sgt. H. H. Kelleway, 561573; F/O. R. L. Lorimer, 37731; P/O. A. G. W. Merewether, 41860; F/O. C. R. Moore, 90098; Sgt. W. M. Mullally, 580583; Sgt. W. S. Nevinson, 580494; F/O. G. E. Saddington, 37945; Act. Flt. Lt. P. E. Warne, 37898; Sgt. R. H. Wills, 580722; L.A/C. E. L. Wolverson, 544700.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—P/O. D. S. Harrison, 83290; Sgt. B. D. Jones, 755459; Sgt. E. D. Jones, 546188; P/O. R. C. Thomas, 82731.

WOUNDED OR INJURED IN ACTION.—Sgt. G. Bartholomew, 520783; L.A/C. R. J. Barton, 524985; Flt. Sgt. F. P. Burnard, 564553; Sgt. J. T. Craig, D.F.M., 564573; Sgt. W. T. Emmerson, 581067; Sgt. A. H. S. Evans, 741895; Flt. Lt. W. R. Farley, 29089; Sgt. D. Farrell, 560754; P/O. G. K. Gilroy, D.F.C., 90481; P/O. O. A. T. Jones, 43693; P/O. J. B. Kendal, 82368; L.A/C. L. G. Ledingham, 520776; P/O. K. J. Marston, 83715; Sgt. D. E. Pearson, 581471; Sgt. S. Reid; Sgt. H. J. Soars, 742705; Sgt. E. J. A. Stephenson, 581061; Sgt. P. H. R. R. A. Terry, 1190615; P/O. T. R. Thomson, 85246; L.A/C. R. G. N. G. Upton, 1376759.

PREVIOUSLY REPORTED "WOUNDED OR INJURED IN ACTION," NOW REPORTED "DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION."—Sgt. A. S. Wilson, 624190.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. A. T. Smith, 968337.

MISSING, BELIEVED "KILLED IN ACTION."—Sgt. H. H. Adair, 580088; A/C.1 K. W. Beavis, 642035; Flt. Lt. A. E. Brian, 39930; Sgt. W. Ellam, 539774; Sgt. J. W. C. Gibson, 653464; F/O. J. M. Hayward, 40111; Sgt. W. J. Mitchell, 755914; P/O. G. R. Rawlings, 79574; Sgt. M. S. Ross, 755445; Sgt. J. A. Selley, 631166; Sgt. C. H. Stubbings, 581045; L.A/C. M. E. Towe, 744561; Sgt. G. S. Wilson, 565830.

"MISSING," BELIEVED "PRISONER OF WAR."—Air Marshal O. T. Boyd, C.B., O.B.E., M.C., A.F.C.; Sgt. C. W. Evans, 619037; Act. Flt. Lt. J. F. Leeming, 77012; F/O. A. J. Payne, 33367; Act. Sqn. Ldr. N. P. Samuels, D.F.C., 29215; P/O. J. C. Watson, 85693; Sgt. W. Wynn, 532132.

"MISSING."—Sgt. P. D. Adams, 551554; Sgt. E. A. Barker, 580732; Sgt. E. J. Bayliss, 581431; Sgt. L. R. Breese, 755007; P/O. A. Bulmer, 74665; Sgt. E. J. Bushell, 751221; Sgt. W. Cave, 751648; Sgt. D. O. Cole, 755025; Sgt. J. Cutler, 649644; Sgt. E. Dawes, 568257; P/O. E. H. Dawson, 41384; P/O. T. Dawson, 42339; Sgt. F. R. Elton, 754825; Sgt. K. Emm, 905343; F/O. S. M. Farries, 40098; L.A/C. R. Fletcher, 535135; Flt. Lt. J. W. S. Fowler, 37765; Sgt. J. Fraser, 965774; P/O. A. H. H. Garrad, 42119; P/O. H. G. Gilbert, 44192; Sgt. K. S. Gowland, 742817; Sgt. G. Graham, 970896; Sgt. J. Greig, 619903; L.A/C. L. C. M. Hale, 522295; Sgt. D. G. Hamilton, 647582; Sgt. R. S. E. Hamilton, 581097; Sgt. F. Harris, 563732; Sgt. E. G. Harding, 749521; P/O. N. Hart, 81879; Sgt. R. L. Hayes, 755394; Sgt. G. Herdman, 632182; Sgt. R. C. Hyland, 580658; Sgt. D. A. Jenner, 759191; P/O. A. L. Jones, 42843; F/O. C. F. Kendall, 70356; F/O. H. B. Kirk, 70708; F/O. M. T. Kirkwood, 39287; Sgt. J. R. G. Lamb, 581017; Sqn. Ldr. G. L. Menzies, 32061; Sgt. A. R. Merry, 936580; Flt. Lt. J. A. F. Mertens, 39100; P/O. W. H. Millington, 42720; P/O. G. Morgan, 80553; Sgt. H. F. J. Moynham, 634201; L.A/C. B. E. Nicholas, 526309; Sqn. Ldr. J. H. R. Oldfield, 32182; Sgt. A. Robertson, 746740; Flt. Lt. K. M. Savage, 37483; Sgt. E. L. Setterfield, 543241; Sgt. E. A. Shapland, 746964; Sgt. P. T. H. Smith, 754103; Sgt. R. W. Spiller, 521985; Sgt. G. A. Stamp, D.F.M., 580074; Sgt. T. Thomas, 561946; Sgt. H. F. Thorndyke, 747794; Sgt. N. Tyson, 755019; L.A/C. R. J. Utteridge, D.F.M., 536916; P/O. O. W. Wakeford, 82681; P/O. C. J. R. Walker, 41759; Sgt. W. L. T. Walker, 935542; A/C.1 L. A. Watchous, 812240; Sgt. O. W. Watt, 630207; Sgt. J. B. Watt, 647062; P/O. A. N. C. Weir, D.F.C., 73593; Sgt. H. C. Westley, 650218; Sgt. W. White, 625991; P/O. L. C. Williams, 42550; Sgt. G. R. Wilson, 808414; P/O. D. H. Wissler, 42665; Sgt. A. Woodburn, 759297.

"KILLED ON ACTIVE SERVICE."—L.A/C. P. K. Abley, 908333; A/C.2 A. W. Allen, 922600; Sgt. G. T. Birkhead, 538032; Sgt. J. Brown, 970119; L.A/C. S. L. Buxton, 744538; A/C.2 A. S. Carrick, 1001528; Flt. Sgt. F. G. W. Cason, 515481; F/O. A. V. K. Chaffey, 41376; Act. F/O. W. R. Corkhill, 42108; L.A/C. V. S. P. Cuthbert, 958005; Act. Sqn. Ldr. H. G. E. Davis, 83484; P/O. R. C. Ensign, 42823; Flt. Sgt. W. Fisher, 508027; Sgt. P. Flanagan, 903094; W/O. L. A. Ford, 846347; Cpl. D. Fox, 535872; Sgt. S. P. Gallagher, 643194; Sgt. H. D. Gaywood, 749520; P/O. D. McI. Gray, 85255; Sgt. J. H. Green, 629031; A/C.2 J. Heyes, 972662; L.A/C. J. J. Holland, 840423; Sgt. D. J. Hooley, 742512; L.A/C. T. L. Hope, 986063; A/C.1 J. G. Humphrey, 954138; A/C.2 S. Knowles, 1106586; L.A/C. W. B. Lambe, 631468; Sgt. F. S. Legge, 742686; Sgt. F. W. Lewis, 631973; Sqn. Ldr. F. M. Loudon, A.F.C., 34046; L.A/C. G. McKillop, 750783; F/O. P. Mallalieu, 41442; L.A/C. T. J. R. Marsham, 902246; Sgt. I. M. K. Miller, 754480; Sgt. N. R. Miller, 748303; Sgt. W. H. Minihane, 568093; Sgt. S. Nicholls, 973969; F/O. A. R. Nivison-Smith, 41454; P/O. J. F. Painter, 40745; P/O. H. C. Parker, 74687; F/O. C. D. Pitman, 70545; Sgt. B. E. Redgrove, 740422; Sgt. R. E. Rollason, 748198; A/C.2 R. R. McH. Rowlands, 1109295; Act. Sqn. Ldr. A. M. Scott, 90369; P/O. R. A. Smith, 82947; L.A/C. F. R. Spencer, 617489; Flt. Sgt. M. G. Steele, 512566; Sgt. E. H. Sturt, 640962; L.A/C. D. R. N. Tooth, 905289; L.A/C. J. L. Walker, 648709; Sgt. G. T. Watt, 516242; Sgt. L. F. Webb, 755836; Cpl. F. Wheatley, 180860; Sgt. E. W. G. Williams, 560735; A/C.2 F. Wright, 116055.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED ON ACTIVE SERVICE," NOW PRESUMED "KILLED ON ACTIVE SERVICE."—Sgt. E. C. Jacobs, 581101; L.A/C. B. Rees, 611643.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED ON ACTIVE SERVICE," NOW REPORTED "KILLED ON ACTIVE SERVICE."—Sgt. R. S. Hartnell, 568749.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED ON ACTIVE SERVICE."—Flt. Sgt. W. T. C. Morman, 560125.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.1 D. Alexander, 966225; L.A/C. A. T. Atkinson, 518082; Sgt. W. Barlod, 523976; Act. Sgt. W. A. T. Beeton, 938107; P/O. E. A. Benjamin, 77777; Act. Flt. Lt. F. W. Berry, 43213; A/C.2 R. J. Biddle, 1357882; A/C.2 G. W. Clay, 1352947; A/C.1 C. Cole, 623905; Act. F/O. R. B. Cleaver, 40889; A/C.2 W. E. Dann, 1183960; A/C.1 J. W. Davy, 1107103; A/C.2 A. W. Dent, 933878; Cpl. A. W. Duncan, 903594; L.A/C. C. H. Edgar, 840779; A/C.1 B. Ellis, 631143; A/C.2 B. H. Finn, 1166923; L.A/C. S. V. Fisher, 964675; L.A/C. L. W. Fiske, 652416; Act. Flt. Lt. D. W. Gathercole, 40529; Cpl. A. P. Gowers, 844507; L.A/C. R. A. Gurney, 626370; A/C.1 F. C. A. Hamilton, 969851; Act. Sgt. J. H. Hawkins, 938318; Sgt. W. E. Kelly, 545640; Sqn. Ldr. G. S. King, 27107; A/C.1 R. G. R. Lamb, 649275; Sgt. J. D. Loach, 742532; L.A/C. S. G. Mark, 901702; L.A/C. H. W. Marnham, 905782; Flt. Sgt. H. Martin, 342333; Sgt. R. H. Moffat, 740613; A/C.2 C. E. Preston, 1110774; Sgt. W. B. Shimmons, 748052; L.A/C. T. H. Standen, 639682; A/C.2 T. Stevens, 1163779; Act. Cpl. A. F. West, 940419; Sgt. G. H. Whalen, 751942; L.A/C. C. G. Young, 910657.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. R. E. Brooks, 930140; L.A/C. F. Gibson, 744543; L.A/C. V. W. Harris, 921743; Sgt. W. W. Hardy, 527784; P/O. I. H. List, 83300; Act. Cpl. H. J. Mallinson, 548098; A/C.2 T. G. Moran, 1053259; A/C.1 J. W. Watson, 168771.

DIED ON ACTIVE SERVICE.—A/C.1 J. T. Balding, 961889; A/C.2 H. F. Beauchamp, 915943; A/C.1 J. H. Betts, 701775; A/C.2 C. D. Bracher, 1172833; A/C.2 W. Clifford, 1105316; P/O. W. L. B. Cochrane, 74596; A/C.2 R. A. Davison, 1258580; A/C.2 M. A. Dyas, 1280320; A/C.2 T. Foster, 980807; L.A/C. D. L. C. Gamet, 611068; A/C.2 L. Godfrey, 1355760; Sgt. P. L. Gregory, 745756; L.A/C. N. G. Jones, 654337; A/C.2 T. B. Mitchell, 922882; Cpl. A. Moore, 508526; A/C.2 W. C. Morgan, 931395; L.A/C. R. G. Mumford, 865676; A/C.2 S. T. Neal, 1158708; Sgt. S. Payne, 754977; Sqn. Ldr. G. Read, 73585; A/C.2 G. H. Riches, 1281319; Sgt. T. Sanderson, 563398; Cpl. M. E. Scrimshaw, 571789; AIC.2 J. C. Sheppard, 1150917; P/O. A. Stevenson, 86776; A/C.1 G. A. Thompson, 980969; L.A/C. G. D. Tilburn, 759209; A/C.2 G. E. Wadey, 1326426; A/C.2 C. R. Weaver, 1309223; L.A/C. J. S. E. Whitmore, 1164402.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—L.A/C. J. Caton, 2730; Sgt. F. R. Conner, 625341; Sgt. R. L. Dean, 746705; Sqn. Ldr. E. D. Elliott, 24205; Sgt. S. A. Elsy, 564041; P/O. J. A. Ferguson, 40814; P/O. B. K. L. Fuge, 41394; P/O. A. B. Goldie, 41281; A/C.1 F. Harris, 663054; Sgt. E. Jones, 745248; F/O. D. B. H. McHardy, 40928; P/O. J. C. Mallon, 42719; Sgt. C. W. Oliver, 740921; Sgt. J. W. B. Phillips, 561185; A/C.2 J. D. Stuart, 638318; A/C.1 F. V. W. Thake, 630382; Sgt. K. S. Thompson, 937784; Sgt. T. F. Williams, 902179.

Royal Australian Air Force

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. S. L. Gardiner, 3215.

Royal New Zealand Air Force

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED IN ACTION," NOW PRESUMED "KILLED IN ACTION."—Sgt. W. D. F. Annan, A391377.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—Sgt. R. B. M. Young, N.Z.40197.

"MISSING," BELIEVED "KILLED IN ACTION."—Sgt. S. H. Macdonald, N.Z.39866.

"MISSING."—Sgt. R. W. Prout, N.Z.39936.

SERVICE AVIATION (CONTINUED)

London Gazette

Royal Air Force

General Duties Branch.

The undermentioned are granted permanent commissions in the substantive rank of Flight Lieutenant (Sept. 14):—Flight Lieutenants (temporary Squadron Leaders): G. D. Garvin, J. C. Millar, H. M. Pinfold, J. B Voyce Flight Lieutenant: V. R. Oats.

The undermentioned are granted temporary commissions as Pilot Officers on being employed with the Royal Air Force:—(Nov. 2) M. G. Grant, 2nd Lt. R.A.S.C.; D. E. S. Hawkins, 2nd Lt., R.A. (T.A.); R. W. Pearson, 2nd Lt., Green Howards; D. Smith, 2nd Lt., R. Tank R.; M. Forster, 2nd Lt., Green Howards; D. R. Chalmers, 2nd Lt., Cameronians; C. MacK. Stickney, 2nd Lt. Green Howards; R. S. A. Jenkyns, 2nd Lt., R.A.; J. D. Richards, Lt., R. Sussex R.; R. F. C. Garvey, 2nd Lt., The R.I. Fus.; W. B. Cairns, 2nd Lt., Gordons; K. S. Booth, Lt., R.A.; J. D. B. Lindsay, Lt., R.A.; D. P. B. Hagan, 2nd Lt., R.A.S.C.; G. B. Dunn, Lt., H.L.I.; A. H. Baird, 2nd Lt., The Queen's R.; A. F. Carlisle, 2nd Lt., D.C.L.I.; T. G. Edwards, 2nd Lt., R.A. (T.A.); H. S. Young, 2nd Lt., Cameronians; (Nov. 3) J. C. Buckley, Capt., R.A. (T.A.); L. J. D. Haley, 2nd Lt., R.A (T.A.)

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Flight Sergeants:—(Apr. 1) G. W. Couzens, H. C. Smith, D.F.M.; (Nov. 5, Sen. Oct. 30) H. S. Sadler. Sergeants:—(Aug. 21, Sen. Aug. 14) H. P. Hopkins; (Aug. 24, Sen. Aug. 21) J. R. Caister; (Sept. 12, Sen. Sept. 11) W. D. G. Watkins, D.F.M.; (Oct. 21, Sen. May 9) P. N. Kingwill; (Oct 30, Sen. Oct. 3) R. F. Wyness, D.F.M.; (Nov. 1, Sen. Oct. 30) B. J. R. George, E. Knowles, D.F.M.; (Nov. 3, Sen. Oct. 23) D. S. Barnes; (Nov. 5, Sen. Oct. 16) N. R. Anstey, D.F.M., I. C. K. Swales Corporal:—(Oct. 20, Sen. May 9) G. C. Strickland.

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(Jan. 13) J. K. Astin; (Feb. 6) M. B. Mallet; (Mar. 16) W. J. Warren; (Mar. 17) T. D. Saul; (June 12) P. A. Clough, A. C. Rowe; (June 26) K. C. Dryden, G. W. O'N Fisher; (July 10) F. G. Denman; (Sept. 6) F. G. Axtell, P. D. Furniss; (Oct. 1) J. Dean, T. S. H. Mainland.

The undermentioned Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers:—(Aug. 10) R. M. Martin; (Sept. 21) E. T. Francis.

Pilot Officer on probation H. G. Edwards is confirmed in his appointment and promoted to the rank of Flying Officer.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 5) D. T. St. H. Dawes, E. C. S. Fewtrell, D.F.C., R. D. Baughan, B. A. Mitchell; (Sept. 8) W. H. Nelson, D.F.C., T. O. Marshall, R. B. Harris; (Sept. 15) E. H. Dean; (Sept. 19) G. E. P. Green; (Sept. 21) P. R. Barr, N. M. Harding; (Oct. 5) J. F. Hyde; (Oct. 15) M. I. Freeman, H. S. Crawford, D. B. Brooks; (Nov. 5) C. S. Harley; (Nov. 10) I. G. Richmond, R. J. Walker.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(July 25) S. B. Morley, D. G. O'Brien, D. A. Beauclair; (Sept. 3) R. W. A. Gibbs, K. Jones, D.F.C.; F. D. Middleton, A. H. Gould, D.F.C., R. Stevenson, L. H. Edwards; (Sept. 23) R. J. K. Hogg, D. Secretan; (Sept. 30) A. B. Corbett, K. W. Michie; (Oct. 2) P. M. de Mestre, D.F.C.; (Oct. 21) J. D. Mundy, R. T. Mulligan; (Nov. 6) N. J. D. Edwards; (Nov. 18) N. O. Clements, A. D. Frampton, C. W. Harper, I. A. Morris.

Flt. Lt. L. W. G. Gill is seconded for special duty (Oct. 1.)

The undermentioned Squadron Leaders are transferred to the Technical Branch:—(Apr 24) H. E. Dicken, J. J. Murphy.

P/O. A. G. Fairhead, 2nd Lt., R.A. (T.A.) relinquishes his temporary commission on return to army duty (Oct. 30).

F/O. F. B. Gabb relinquishes his short service commission on account of ill-health (Nov. 26).

Sqn. Ldr. T. G. L. Gale resigns his commission (Nov. 17).

Technical Branch.

The undermentioned are granted commissions for the duration of hostilities:—As Flying Officers on probation: Warrant Officers:—(Nov. 5, Sen. Oct. 23) W. H. Charlton; (Nov. 8, Sen. Oct. 23) E. V. Allen; (Nov. 9, Sen. Oct. 25) S. H. Jordan. As Pilot Officers on probation: Warrant Officer:—(Nov. 9, Sen. Oct. 25) H. F. Davis. Flight Sergeants:—(Oct. 1, Sen. Aug. 3) J. H. Steer; (Nov. 4, Sen. Oct. 28) H. H. C. Hester; (Nov. 7, Sen. Oct. 23) C. W. R. Baker; (Nov. 10, Sen. Oct. 24) E. C. Blissett.

The undermentioned Flying Officers on probation are confirmed in their appointments:—(Aug. 10) W. H. York; (Aug. 11) J. Gallie; (Aug. 26) C. F. Howard, A. W. Green; (Aug. 31) L. P. O'Connor; (Sept. 27) E. Plowright.

Balloon Branch.

Flt. Sgt. J. W. D. Brangan is granted a commission for the duration of hostilities as Pilot Officer on probation (Oct. 29, Sen. Oct. 11).

Administrative and Special Duties Branch

The undermentioned are granted commissions for the duration of hostilities:—As Flying Officers on probation; Warrant Officers:—(Aug. 13, Sen. July 24) C. A. Streeter; (Aug. 14, Sen. July 10) T. C. Power; (Oct. 16, Sen. July 24) L. R. Collins; As Pilot Officers on probation:—Warrant Officers:—(July 20, Sen. July 10) A. E. Bibb; (Sept. 2, Sen. Aug. 2) J. S. Deag; (Oct. 24, Sen. Oct. 14) R. C. Davey; (Nov. 11, Sen. Oct. 23) L. J. Nolder; Flight Sergeant:—(Aug. 17, Sen. July 24) C. A. Mortimor; Sergeants:—(Aug. 7, Sen. July 27) G. Law; (Nov. 7, Sen. Oct. 24) C. E. Stansfield; (Nov. 11, Sen. Oct. 23) S. J. W. Ford, C. Couzens; Corporal:—(Aug. 15, Sen. July 24) R. R. Chapman.

Equipment Branch.

The undermentioned are granted commissions for the duration of hostilities:—(Nov. 1): As Pilot Officer on probation: Warrant Officer (Sen. Sept. 3) A. R. G. Wolff. As Acting Pilot Officers on probation: Sergeants (Sen. Aug. 29) E. G. B. Hughes; (Sen. Aug. 14) N. J. Jones; (Sen. Aug. 29) B. H. Miles.

The undermentioned Flying Officers on probation are confirmed in their appointments:—(Sept. 18) W. Higgs, A. J. Green, A. G. Cooper; (Oct. 31) A. Paton.

The undermentioned Pilot Officers on probation are confirmed in their appointments, Aug. 17, and promoted to the rank of Flying Officer:—(Sept. 6) J. S. Miller; (Sept. 29) F. J. Ford; (Oct. 13) D. S. Sanderson; (Oct. 25) C. M. Gilbert.

F/O. D. Holbrook is promoted to the rank of Flight Lieutenant (Sept. 4)

F/O. on probation G. R. C. Baker is transferred to the Administrative and Special Duties Branch (Nov. 13).

Accountant Branch

Flt. Sgt. J. W. H. Dailly is granted a commission for the duration of hostilities as Acting Pilot Officer on probation (Nov. 4, Sen. Oct. 2).

Medical Branch.

Flt. Lt. B. G. Haynes, M.B., B.S., M.R.C.P., is granted a permanent commission in the substantive rank of Flight Lieutenant (Sept. 6).

Miss G. E. M. Meyer, M.R.C.S., L.R.C.P., is appointed as Medical Officer with the relative rank of Flying Officer (Nov. 5).

F/O. J. W. Reade, M.B., Ch.B., B.A.O., is promoted to the rank of Flight Lieutenant (Sept. 4, with seniority of Sept. 4, 1939).

Dental Branch.

F/O. F. D. Baron, L.D.S., is promoted to the rank of Flight Lieutenant (Sept. 4).

Royal Air Force Reserve

Reserve of Air Force Officers.

General Duties Branch.

Act. P/O. on probation J. E. Storey is confirmed in his appointment and graded as Pilot Officer (Apr. 29).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant: (Sept. 7) E. W. Seymour-Hosley; (Sept. 8) S. Le Rougetel, T. P. De la Rue; (Sept. 18) P. J. Halford; (Sept. 25) J. T. S. Horsfall; (Oct. 14) W. R. Walwin; (Oct. 15) W. J. E. Craigen.

F/O. W. R. Wilson resigns his commission (Oct. 28).

Administrative and Special Duties Branch.

F/O. R. H. Rose is transferred to the General Duties Branch (July 15).

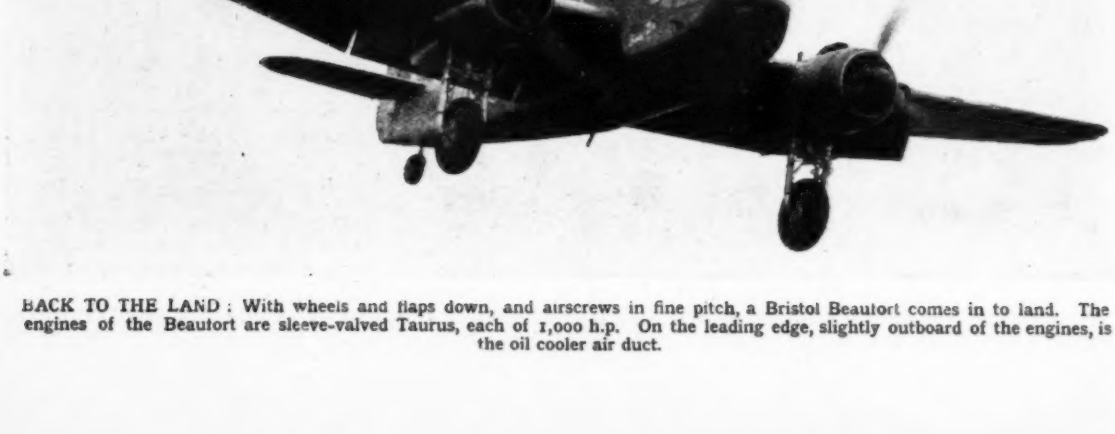
F/O. O. M. Baldwin, D.F.C., is transferred to the Technical Branch (Nov. 3).

Royal Air Force Volunteer Reserve

General Duties Branch.

Flt. Lt. J. F. F. Finnis, Southern Rhodesian Air Force, is granted a commission for the duration of hostilities as Pilot Officer on probation (Temp. Flight Lieutenant) (Aug. 1, Sen. Jan. 1).

The undermentioned are granted commissions for the duration of hostilities: As Flying Officers: (Nov. 1) A. T. Gillard, J. P. Malley, C. W. Roberts; (Nov. 12) A. C. Gardner, N. E. M. Giles. As Pilot Officers on probation: (Oct. 21) J. P. R. Galbraith; (Nov. 4) G. B. Pollard; (Nov. 7) M. V. Spurway; (Nov. 9) F. Stanley. Sergeants: (Aug. 17) P. A. Mortimer; (Sept. 7) R. Smith; (Oct. 5) G. H. Cowings; (Oct. 19) G. F. E. Greenhalgh, S. L. Bailey, F. H. Cook; (Nov. 2, Sen. Oct. 30) R. F. Eastwood, F. H. Gledhill; (Nov. 2) G. F. Simpson, I. M. Strachan, A. F. George, T. L. Hayston; (Nov. 3, Sen. Nov. 2) A. N. Jacob, H. C. Butler, C. E. Greville-Heygate, G. A. Harrison, A. E. Hilditch, G. F. Kilburn, E. Hewson, H. H. Siddell; (Nov. 4, Sen. Oct. 27) R. Warburton; (Nov. 7, Sen. Oct. 16) R. D. Dunscombe; (Nov. 9, Sen. Nov. 3) J. Burningham; (Nov. 16) P. J. Dale, E. A. Scott. Acting Corporal: (Oct. 20) K. E. R. Booth. Leading Aircraftmen: (Sept. 7) P. H. Foster; (Sept. 22) K. C. Browne; (Oct. 6) J. Carter; (Oct. 19) D. C. Rustom, D. J. Bell, A. F. Phillips, B. J. A. Rennie, G. G. Davies, W. Fullerton, A. Watson; (Oct. 20) L. B. Hewitson, J. E. Shannon, R. G. Wales, J. G. Mutter, R. G. Sammons; (Nov. 2, Sen. Oct. 19) S. A. Tucker; (Nov. 2) M. B. Curtis, I. W. Macrobert, R. Rymer, A. W. B. Newman, G. N. Busbridge, E. E. Sergeant, R. A. Webb, S. H. Dale; (Nov. 3) D. A. G. Blakely, A. F. Buck, G. A. Campbell, L. J. Francis, E. C. Stewart, R. W. Williams, C. W. B. Massey; (Nov. 5) G. C. Blunt, T. K. Wyles, B. S. Booker, S. C. G. Buszard; (Nov. 4, Sen. Oct. 27) S. R. Whiting, W. C. Wilson; (Nov. 4, Sen. Oct. 29) J. C. S. Doll, N. C. Downie, R. R. Harries, W. L. Beech, H. P. Lardner-Burke, C. A. Newman; (Nov 9, Sen. Oct. 27) K. L. Collinson, H. G. S. Pennick; (Nov. 9, Sen. Oct. 29) R. E. Archibald, W. R. Curtis, A. R. Hall; (Nov. 9, Sen. Nov. 3) N. S. Dunkerton, S. J. Pollock, S. G. Nicoll; (Nov. 16) W. Baser; (Nov. 18, Sen. Oct. 27) R. S.



BACK TO THE LAND: With wheels and flaps down, and airscrews in fine pitch, a Bristol Beaufort comes in to land. The engines of the Beaufort are sleeve-valved Taurus, each of 1,000 h.p. On the leading edge, slightly outboard of the engines, is the oil cooler air duct.

EFFICACIOUS : A nearly full front photograph of the Fairey Fulmer, the Fleet's new fighter. Under the wings, on each side, can be seen the four orifices out of which discharge the spent cartridge cases and disintegrating belt links from the eight Brownings.

Miller. As Acting Pilot Officer on probation : (Nov. 2) E. D. A. Shepherd.

P/O. on probaton W. D. Macpherson is confirmed in his appointment (Sept. 27).

The undermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer :—(Sept. 18) R. L. Beverley, J. R. Micklethwait; (Sept. 20) P. Drummond; (Oct. 3) K. L. Millar, J. K. Badcock; (Oct. 5) G. W. Alexander; (Nov. 1, Sen. Sept. 14) M. Garden, A. T. Grieve.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant :—(Sept. 3) J. W. J. Truran; (Oct. 19) R. L. Culley.

P/O. on probation F. A. Wray is transferred to the Administrative and Special Duties Branch (Nov. 9).

The commissions of the undermentioned Pilot Officers on probation are terminated on cessation of duty :—(Nov. 11) D. G. Gething; (Nov. 14) L. L. Sullivan.

The notification of Sept. 3 concerning Flt. Lt. R. M. Marshal, Southern Rhodesian Air Force, is cancelled.

The notification of Sept. 27 concerning the undermentioned Sergeants is cancelled :—A. C. W. Holland, R. T. Turton, C. Merrick, D. C. L. Chidell, R. S. Radley, R. J. Roake, D. H. Skinner, P. S. James, R. H. McGowan, W. McRobbie, F. G. Malim, H. J. W. Meakin, P. D. Pool, R. H. Thomas, J. Wotherspoon.

Errata.

The notification of Sept. 27 concerning Sgt. G. M. Brisbane should have appeared under the heading "R.A.F.," and not "R.A.F.V.R."

The notification of Nov. 5 concerning Sgt. R. McDougall is cancelled.

Technical Branch.

Flt. Sgt. A. C. Elmy is granted a commission for the duration of hostilities as Pilot Officer on probation (July 16, Sen. May 16).

P/O. on probation J. R. Boundy is confirmed in his appointment (Oct. 11).

P/O. on probation R. W. Serjeantson is confirmed in his appointment and promoted to the rank of Flying Officer (Nov. 21).

Balloon Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation :—Corporal : (Oct. 31, Sen. Sept. 27) W. Sharples. Leading Aircraftmen : (Nov. 8, Sen. Oct. 22) R. P. L. Thompson; (Nov. 6, Sen. Sept. 19) G. E. Assinder. Aircraftmen 1st Class : Nov. 7, Sen. Oct. 21) P. R. C. Benson; (Nov 4, Sen. Sept. 4) S. Holden. Aircraftman 2nd Class : (Nov. 7, Sen. Oct. 21) T. J. Lewis.

The undermentioned Pilot Officers on probation are confirmed in their appointments :—(Oct. 6) R. C. Crowden; (Oct. 24) F. L. M. Harris.

The undermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer :—(Oct. 1) R. D. Dykes; (Oct. 3) H. Sutherland; (Oct. 5) A. L. Grice, S. F. R. Hulbert, D. R. H. Levett, R. Lutyens, I. R. Parry, C. Tully, P. L. Wheeley.

P/O. on probaton G. P. Dealtry is confirmed in his appointment Oct. 6 and promoted to the rank of Flying Officer (Oct. 12).

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities :—As Flying Officers on probation : (Oct. 3) D. W. Mair; (Oct. 4) F. E. Trevlyn Clark, H. E. Langley, L. C. Munn. As Pilot Officers on probation : (July 2) A. B. Gibaud, H. J. Sketch (substituted for notification of Aug. 20); (July 3) St. V. F. Hammick; (July 15) B. R. Catcheside; (July 23) G. P. Hacking; (Aug. 7) E. D. Renwick; (Aug. 12) H. N. Roffey (substituted for notification of Oct. 22); (Aug. 16) C. H. V. Longley; (Aug. 21) G. D. Cheyne; (Aug. 30) T. Frame-Thomson, O. L. Hyde, T. S. Lofthouse; (Sept. 7) V. Brent; (Sept. 11) E. M. Downes; (Sept. 14) J. W. Combe; (Sept. 16) A. R. Boyce, F. I. Nicolson; (Sept. 18) H. W. Howarth, F. M. Scorer; (Sept. 19) H. H. Loveday; (Sept. 20) C. J. D. Davis; (Sept. 27) T. V. Smith; (Sept. 30) D. A. Gleave; (Oct. 2) G. J. Binks, G. J. A. House; (Oct. 3) N. A. Martin R. C. B. Swaine; (Oct. 5) H. W. Bland, L. J. P. Graham; (Oct. 7) R. J. Keir, H. J. Westley; (Oct. 8) J. B. Cockin, E. W. Howles; (Oct. 12) J. B. C. Robertson; (Oct. 13) E. G. S. Cook, J. L. Furner; (Oct. 15) J. A. Toubkin; (Oct. 16) W. E. M. Slocock; (Oct. 17) A. W. Clark; (Oct. 18) A. Tustin; (Oct. 19) R. McK. Colvill; (Oct. 20) C. L. R. Jensen; (Oct. 21) A. R. Cottle, J. N. McHale, D. G. Pinnell; (Oct. 22) A. Glendinning, R. T. Lund, W. M. Miller; (Oct. 23) G. H. Hadley; (Oct. 24) T. G. North; (Oct. 26) C. T. T. R. Bouchet, F. B. Spedding, M.C.; (Oct. 28) R. M. Campbell, W. R. Maguire, G. D. Nicholl, R. J. D. Belgrave, D. MacQueen; (Oct. 30) F. N. Corben, M.C., W. G. Hire; (Nov. 1) D. R. Lloyd, J. E. Tuttle; (Nov. 2) F. H. Lawrence, D. McN. Livingstone, B. Pooley; (Nov. 4) E. H. Barber, S. W. Evans, J. Hiley, W. T. G. Parker, S. S. Peters, J. C. Scott, W. C. Stokes, W. F. Ware, E. S. E. Clark; (Nov. 5) R. P. Clegg, H. Crowhurst, R. H. Millington, J. R. O'Grady, V. J. R. D. Prendergast; J. S. Rogers, A. R. Sinclair, R. M. Walker, D. L. Walters; (Nov. 7) H. Ford, T. Godman, F. W. Palmer, V.C., M.M., P. Wilson; (Nov. 8) C. Challen; (Nov. 9) F. Simmons. Warrant Officer : (Sept. 25, Sen. July 24) R. F. James. Sergeant : (Oct. 29, Sen. Apr. 25) D. F. Wakley. Leading Aircraftman : (Aug. 17, Sen. Aug. 6) E. P. Duncan. Aircraftman 1st Class : (July 18, Sen. July 10) J. J. P. Dudley. Aircraftman 2nd Class : (Aug. 28, Sen. Aug. 22) R. C. Ruck, O.B.E; (Oct. 18, Sen. Aug. 16) E. J. C. Hatchard. As Acting Pilot Officers on probation : Sergeant : (Oct. 14, Sen. Aug. 26) D. J. Everett. Leading Aircraftman : (Nov. 2, Sen. Oct. 14) J. M. Barton. Aircraftman 2nd Class : (Oct. 25, Sen. Aug. 29) R. J. Madill.

P/O. on probation G. F. C. Caswell is confirmed in his appointment and promoted to the rank of Flying Officer (July 25).

Hon. Flt. Lt. W. E. Symonds is granted the honorary rank of Squadron Leader (June 21).

P/O. on probation D. C. Shaw is transferred to the General Duties Branch (July 27).

The undermentioned Pilot Officers on probation relinquish their commissions on account of ill-health :—(Nov. 26) R. A. Bradley, C.M.G., E. H. Arkwright.

The undermentioned resign their commissions :—Flying Officers : (Nov. 6) W. E. Taylor; (Nov. 10) C. T. S. Mendl; (Nov. 14) I. C. Tyler. Pilot Officers on probation : (Sept. 14) H. F. Towler; (Oct. 23) E. R. B. Drummond; (Nov. 10) A. S. Allberry; (Nov. 17) M. L. Lakin.

The commissions of the undermentioned Pilot Officers on probation are terminated on cessation of duty :—(Sept. 18) L. J. Lumby, E. A. Richards; (Oct. 15) F. Wells; (Oct. 28) F. A. L. de Gruchy; (Nov. 10) A. E. Straw; (Nov. 13) W. Ferguson; (Nov. 14) W. Houston, W. J. Walker, S. Janson; (Nov. 15) P. D. Saxton.

Errata.

In notification of Oct. 8 concerning W. Hewett *For* Hewett *read Hewitt.*

Equipment Branch.

The undermentioned are granted commissions for the duration of hostilities (Nov. 1) :—As Acting Pilot Officers on probation : P. H. G. Beckman, J. H. Bidlake, T. P. H. Blake, A. G. Curtis, M. J. E. F. H. de Froberville, T. H. Fordham, K. Garcke, R. G. Gibbons J. H. L. Griffin, E. A. Hillman, R. W. H. Killick, B. A. Maisel, J. A. L. Moore, N. W. Robinson, J. A. Todd, J. D. Vestey, J. B. Ward, J. H. Watson, J. C. Williams, K. H. Williman, S. F. Wood. Corporals : (Sen. Aug. 29) H. G. Rae, J. A. J. Taylor. Leading Aircraftman : (Sen. Aug. 29) L. A. Rabbitts. Aircraftman 1st Class : (Sen. Aug. 21) K. H. Woodroffe. Aircraftman 2nd Class (Sen. Aug. 21) : N. E. Bradley.

The undermentioned Pilot Officers on probation are confirmed in their appointments :—(Sept. 9) J. L. Bush; (Sept. 11) G. F. Woolf; (Nov. 13) R. S. Swanton; (Nov. 14) E. A. Waterton; (Nov. 15) A. C. Flavell; (Nov. 17) A. B. W. Greenhough.

The undermentioned Pilot Officers on probation are confirmed in their appointments Sept. 13, and promoted to the rank of Flying Officer :—(Nov. 19) B. A. W. Baird, P. J. Bleech, C. A. W. Carter, D. W. Charles, B. H. Edwards, A. A. Solly.

P/O. on probation H. N. Reynolds M.C., is confirmed in his appointment and promoted to the rank of Flying Officer (Sept. 13).

Accountant Branch.

The undermentioned are granted commissions for the duration of hostilities as Acting Pilot Officers on probation (Nov. 2) :—Leading Aircraftmen (Sen. June 6) : C. L. Lumley-Ellis; (Sen. Oct. 2) R. W. Shiner. Aircraftman 1st Class (Sen. Sept. 24) : L. Swann.

P/O. on probation P. Goldsmith is confirmed in his appointment (Sept. 1).

SERVICE AVIATION (CONTD.)

P/O. on probation R. G. Penny is confirmed in his appointment (Sept 1), and promoted to the rank of Flying Officer (Oct. 11).

The undermentioned Pilot Officers on probation are confirmed in their appointments Sept. 11, and promoted to the rank of Flying Officer :—(Oct. 10) N. Mayhew; (Oct. 19) J. R. Skelton.

P/O. on probation A. G. Stringer is confirmed in his appointment, and promoted to the rank of Flying Officer (Oct. 21).

P/O. on probation A. Siddall resigns his commission (Nov. 6, 1939).

Medical Branch.

A. F. Pearson, M.B., Ch.B., is granted a commission for the duration of hostilities as Flying Officer (Oct. 25).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant :—(Sept. 18) J. Sutcliffe M.B., B.Ch.; (Sept. 25) D. McGregor, M.B., Ch.B.; (Oct. 12) B. M. Phillips, M.R.C.S., L.R.C.P., D.A.; (Oct. 17) J. G. Bate, M.B., Ch.B., K. V. Jackson, M.R.C.S., L.R.C.P.; (Oct. 24) R. G. D. Forward, M.B.B.Chir., M.R.C.S., L.R.C.P., S. F. Robertson, M.D., F. N. Shuttleworth, M.B., Ch.B., D. Turner, M.B., Ch.B., M.R.C.S., L.R.C.P.; (Oct. 27) J. S. Astbury, B.M., B.Ch.; (Nov 15) J. D. Ebsworth, M.R.C.S., L.R.C.P.

Dental Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant :—(Sept. 18) P. White L.D.S.; (Sept. 25) O. B. Balean, L.D.S., R.C.S.; (Sept. 27) J. R. Humphreys, L.D.S., R.C.S.; (Oct. 2) H. N. Squire, L.D.S., R.C.S.

Chaplains Branch.

The undermentioned are granctd commissions for the duration of hostilities with the relative rank of Squadron Leader :—(Nov. 1) The Rev. R. F. Rainsford; (Nov. 6) The Rev. W. Young; (Nov. 12) The Rev. P. C. A. Usher.

Auxiliary Air Force

General Duties Branch.

The undermentioned Act. Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers :—(July 29) H. P. Taylor; (Sept. 7) C. M. Elgar.

P/O. H. P. Taylor is transferred to the Administrative and Special Duties Branch (July 29).

Balloon Branch.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer :—(Oct. 7) I. A. Macaulay; (Oct. 11) A. P. Cotterel (Oct. 17) N. W. Slack, E. L. Fenton, J. Walton, G. F. Sharpe, G. V. Wright.

F/O. A. R. Hind resigns his commission (Nov. 20).

Women's Auxiliary Air Force

The undermentioned are appointed Assistant Section Officers :—(Nov. 8) Sgt. Miss P. T. Gollance; (Nov. 16) A/CW.1 Miss N. Atkins, A/CW.2 Miss J. P. Cleeve, A/CW2 Miss K. P. Cleeve, A/CW.2 Mrs. C. Durrant, A/CW.1 Mrs. B. E. Harthan, Cpl. Mrs. D. A. Haseler, A/CW.1 Miss D. M. M. O. Lewis, A/CW.2 Miss J. J. Rankin, A/CW.1 Miss M. T. Ryan, A/CW.2 Mrs. N. M. H. A. Tobin, A/CW.1 Miss S. M. Watts.

Assist. S/O. Miss J. M. B. Connolly relinquishes her appointment (Oct. 23).

Assist. S/O. Miss M. J. Baker relinquishes her appointment on ceasing to be employed (Nov. 20).

Errata.

In notification of Nov. 12 concerning Cpl. Miss L. P. West. *For* Miss L. P. West *read* Mrs. L. P. Nightingale.

THE INVISIBLE MAN : Modern head gear worn by our high-flying pilots has quite a Wellsian touch about it.

THE INDUSTRY

O.M.T. Omtimeter

THIS instrument is designed for speedy, accurate setting, but, at the same time, the method of adjustment, particularly with regard to the table, is such that once the instrument has been set up for any given checking operation, it is then foolproof in spite of its sensitivity. The projection attachment, whilst speeding up actual tests with the instrument, will also be found extremely useful in arranging accurate set ups.

In arranging the instrument for measuring a job in conjunction with standard gauge blocks, the gauge block is first set up under the plunger of the Omtimeter and the table adjusted so that the pointer on the scale reads zero. Diversions from correct measurement will then be shown accurately on the scale when the work is subsequently placed on the table beneath the plunger.

In this preliminary setting up it is, of course, essential that the table shall be parallel to the plant of the contact tip in the plunger and means of securing absolute parallelism of the table are provided by 3-point supports consisting of a fixed ball point and two knurled adjusting screws. Accurate means of adjusting the table vertically are also furnished. For this purpose the large knurled locking screw below the table on the right-hand side is provided for use in conjunction with the larger knurled ring nut directly above the foot of the stand.

The O.M.T. Omtimeter and a close view of the projection magnifier.

To avoid the necessity of the operator viewing the scale close up through the magnifier, a projection attachment has been furnished and this results in considerably speeding up operation of the instrument. The degree of enlargement of the scale can readily be seen from the photograph and it will be observed that each graduation on the scale represents 0.00005in. Magnification of the scale is such that differences of this amount can be seen instantaneously when the work is placed under the plunger.

The projection attachment is also of great assistance in securing absolute parallelism of the table with the plant of the contact point prior to any given measuring operation. If, for instance, a standard gauge block is placed on the table when it is not truly parallel, then movement of the gauge block across the contact point in one direction or another will reveal non-parallelism by a movement of the scale seen through the projection attachment. It will readily be seen that adjustments of the table are much more simple with the projection attachment than would be the case if the operator had to view the scale close up through the magnifier.

The range of the scale is ± 0.005in. and work up to 7in. can be tested.

It is manufactured by Optical Measuring Tools, Ltd., and marketed by E. H. Jones (Machine Tools), Ltd., Edgware Road, N.W.9, who are the sole agents.

Pay While Training

A SHORT training scheme, recently introduced with the object of assisting in the speed-up of production of flying-boats for the R.A.F., has proved so successful that the aircraft firm concerned—Saunders-Roe, Ltd.—have decided to extend its scope. Until recently all trainees were from a certain defined area, but in future they will come from all parts of the country.

Scores of persons who have passed through the school are at the moment employed in the main factories, on such work as detail fitting, sub assembly and main assembly. During training they are paid at the rate of 11d. per hour, plus the national bonus of 15s. for a 47-hour week. Those now absorbed into the factories are being paid 1s. 4d. per hour and the national bonus of 15s. Unskilled women are also being trained for work in the factory. The skilled employees are giving their full co-operation, and there is no ruling as to the percentage of trainees to be passed into the workshops.

Living accommodation, in flats conveniently situated near the factories, is provided at rentals varying from 7s. 6d. for a one-bedroomed flat to 17s. 6d. for a flat with three bedrooms.

Production Tonic

MORE than 500 men and women of British Timken, Ltd., Birmingham, are having artificial sunlight treatment regularly. This is free and is taken in working hours. With winter here, more and more workers are taking advantage of the facilities provided by the directors.

A doctor attends regularly, examines the workers first and prescribes treatment, which is given under fully qualified supervisors. Usually only four minutes are given at first, gradually increasing to twenty minutes over the four to six weeks' course. The ultra-violet ray lamps are installed in the centre of the sunlight rooms and white rings on the floors are guides to the intensity. As the course progresses, the worker moves inwards from the outer circle.

Careful records are being kept to test the effects of the treatment. Mr. F. J. Pascoe, Director of British Timken, said in an interview:

"While our records have not been kept long enough to enable us to come to any conclusions based on statistics, we are definitely of the opinion already that this sunlight treatment helps to combat the effects of the black-out and the long working week. I think it is a very good production tonic."

NEW COMPANIES

CURRAN INDUSTRIES, LTD.—Private company. Registered October 30. Capital £10,000 in 10,000 shares of £1 each. Objects: To carry on the business of hardware manufacturers and merchants, building material manufacturers and merchants, constructional and mechanical engineers, tool makers, coal, fuel oil, peat and coke merchants, colliery proprietors and agents, pitwood and general timber merchants, sawmill proprietors, etc. The directors are: John Curran, 115, Penylan Road, Cardiff; Paul E. Curran, Mor-Hafren, West Drive, Porthcawl, Glam. (both directors of Edward Curran and Co., Ltd.). Both the above are permanent. Solicitors: Gilbert Robertson and Co., Cardiff Docks. Registered office: Hurman Street, Bute Docks, Cardiff.

CURRAN PRODUCTS, LTD.—Private company. Registered October 30. Capital £10,000 in 10,000 shares of £1 each. Objects: To carry on the business of aircraft and aircraft component manufacturers, aircraft assemblers, constructional and mechanical engineers, tool makers, coal, fuel, oil, peat and coke merchants, colliery proprietors and agents, pitwood and general timber merchants, sawmill proprietors, etc. The directors, solicitors and registered office are similar to those of Curran Industries, Ltd. (q.v.).

BRITISH CONTINENTAL AIRWAYS TRUST COMPANY.—Registered as a public company on October 29, with a nominal capital of £1,600 in 384,000 shares of one penny each. Objects: To acquire and hold shares in Rollason Aircraft Services, Ltd., and shares and securities of any other company, Government or authority, and to carry on the business of financiers, etc. The directors are: Percy G. Mackinnon, High Quarry, Crockham Hill, Kent, underwriting member of Lloyds; Fdk. W. Farey-Jones, Ruffetts Wood, Chipstead, Surrey, insurance broker; John R. Bryans, 16, Lowndes Street, S.W.1, insurance broker; Graham Mackinnon, How Green, Hever, Kent, underwriting member of Lloyds; John Carr, 38, Donegall Place, Belfast, stockbroker. Solicitors: Waterhouse and Company, 1, New Court, Lincoln's Inn, W.C.2.

AERONAUTICAL PATENTS

1939.

5380. NORTH, J. D., and BOULTON PAUL AIRCRAFT, LTD. Loading mechanism for machine guns (525,336).

5625. DE HAVILLAND AIRCRAFT CO., LTD., and KING, E. P. Airscrew blades (525,414).

5778. BRITISH THOMSON-HOUSTON CO., LTD., and CLARK, L. J. Means for heating parts of aircraft (525,452).

6078. FAIRBROTHER, H. (Bayerische Motoren Werke Akt.-Ges.). Change-speed airscrew gearing with pressure oil control (525,615).

6082. SPERRY GYROSCOPE CO., INC. Automatic pilots for aircraft (525,617).

6259. ARMSTRONG WHITWORTH AIRCRAFT, LTD., SIR W. G., and TAYLOR, J. L. Aircraft wings (525,666).

6481. COWDREY, C. L. Exhaust systems of internal-combustion engines on aircraft (525,468).

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1103. FAIREY AVIATION CO., LTD., HILLS, J. L., and HOVELL, P. B. Signalling, indicating, or like means for use in fog (525,880).

3034. SHORT, F. Apparatus for removing ice or other substance from a surface on which it has congealed (525,818).

6404. DAIMLER-BENZ AKT.-GES. Aerials for vehicles (525,720)

6634. AEROPLANI CAPRONI SOC. ANON., and LANCIANI, E. Multi-barrel machine guns. (525,780).

6728. ELEKTRON CO., GES. Manufacture of wheels for aircraft (525,833).

6759. I.S.S.A. INDUSTRIA SPECIALIZZATA STRUMENTI AERONAVIGAZIONE SOC. ANON., and LANCIANI, E. Sight-correcting devices for guns for example, machine guns, arranged to be carried by vehicles, particularly aircraft (525,838).

6990. JUNKERS FLUGZEUG-UND-MOTOREN-WERKE AKT.-GES. Supporting wheels for erecting devices for aircraft (525,926).

7031 BRISTOL AEROPLANE CO., LTD., and COPLEY, J. W. Liquid-cooling apparatus for use in conjunction with an aircraft engine (525,937).

7054. ROBERT, R. Aeroplane wing-flaps and ailerons (525,942).

7137. KRUPP AKT.-GES., F. Armoured cupolas. (525,978)

7247. BLACKBURN AIRCRAFT, LTD., and HILL, H. E. Aircraft (526,004).

4881. ALGARSSOM, G. Variable-pitch propellers (525,809).